PRELIMINARY INSTRUCTIONS

FOR

RADIO TRANSMITTER BC-375-D

AND

ASSOCIATED EQUIPMENT

Manufactured by
GENERAL ELECTRIC COMPANY
U.S.A.

RESTRICTED

PUBLISHED BY AUTHORITY
OF
THE CHIEF SIGNAL OFFICER

Order No. 6414-NY-41

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SAFETY TO HUMAN LIFE

OPERATION OF THIS EQUIPMENT INVOLVES THE USE OF HIGH VOLTAGES WHICH ARE DANGEROUS TO LIFE. OPERATING PERSONNEL MUST AT ALL TIMES OBSERVE ALL SAFETY REGULATIONS. DO NOT CHANGE TUBES OR MAKE ADJUSTMENTS INSIDE EQUIPMENT WITH HIGH VOLTAGE SUPPLY ON. DO NOT COMPLETE OR MAINTAIN ANY CONNECTION BETWEEN RADIO TRANSMITTER AND DYNAMOTOR UNIT UNLESS ALL SHIELDS ON THE TRANSMITTER ARE IN PLACE.

KEEP AWAY FROM LIVE CIRCUITS

1. Under no circumstances should any person be permitted to operate the dynamotor with fuse box cover or end bells removed; or to replace fuses with power on; or to remove, place, or handle removed plugs with the dynamotor unit running.

2. Under no circumstances adjust circuits or service the equipment when the carrier is keyed off only. The radio transmitter uses a grid-bias keying circuit, which does not remove high voltage when the key is open.

DO NOT OPERATE THE EQUIPMENT WITH SHIELDS REMOVED

TABLE OF CONTENTS

SECTION I

DESCRIPTION OF COMPLETE EQUIPMENT

Par.		Page
1	General	1

SECTION II

INSTALLATION

2.	General	1
3.	Radio Transmitter BC-375-D (Includes Mounting FT-151-A)	1
4.	Dynamotor Unit PE-73-C	1
5.	Cords	2
6.	Antennas	2
7.	Antenna Tuning Unit BC-306-A	2
8.	Reel RL-30-B and Connector Clamp MC-163	2
9.	Interconnection with the Radio Receiver in Aircraft	3

SECTION III

PREPARATION FOR USE

10.	General	3
11.	Radio Transmitter BC-375-D	3
12.	Operation at High Altitude	4
13.	Dynamotor Unit PE-73-C	4

SECTION IV

OPERATION

14.	Radio Transmitter Adjustment	4
15.	Antenna Adjustments	6
16.	Dynamotor Unit PE-73-C	8
17.	Reel RL-30-B	8
18.	Operating Routine	9
19.	Summary Covering Normal Operation	9

SECTION V

MAINTENANCE AND REPAIR

20.	Inspection	10
21.	Lubrication	10
22.	Service Notes	11

LIST OF ILLUSTRATIONS

Fig. 1. Radio Transmitter BC-375-D, Schematic Diagram

Fig. 2. Radio Transmitter BC-375-D, Connection Diagram

Fig. 3. Radio Transmitter BC-375-D, Dimensions and Weights

Fig. 4. Transmitter Tuning Units, TU-5-B, TU-6-B, TU-7-B, TU-8-B, TU-9-B, TU-10-B, TU-22-B, and TU-26-B; Schematic Diagrams

Fig. 5. Transmitter Tuning Unit TU-5-B, Connection Diagram

Fig. 6. Transmitter Tuning Unit TU-6-B, Connection Diagram

Fig. 7. Transmitter Tuning Unit TU-7-B, Connection Diagram

Fig. 8. Transmitter Tuning Unit TU-8-B, Connection Diagram

Fig. 9. Transmitter Tuning Unit TU-9-B, Connection Diagram

Fig. 10. Transmitter Tuning Unit TU-10-B, Connection Diagram

Fig. 11. Transmitter Tuning Unit TU-22-B, Connection Diagram

Fig. 12. Transmitter Tuning Unit TU-26-B, Connection Diagram

Fig. 13. Case CS-48, Dimensions and Weight

Fig. 14. Dynamotor Unit PE-73-C, Connection Diagram

Fig. 15. Dynamotor Unit PE-73-C, Dimensions and Weights

Fig. 16. Antenna Tuning Unit BC-306-A, Connection Diagram

Fig. 17. Antenna Tuning Unit BC-306-A, Dimensions and Weights

Fig. 18. Mounting FT-115-B, Dimensions and Weight

SECTION I

DESCRIPTION OF COMPLETE EQUIPMENT

1. GENERAL

Radio Transmitter BC-375-D with its associated equipment is designed for aircraft and for applications requiring a medium power equipment with the characteristics of strength, light weight, flexibility and portability. The equipment is designed to provide communication by voice, tone, or continuous wave telegraph over the frequency range of 150 to 12,500 kilocycles. However, only the frequencies covered by the transmitter tuning units listed in next column are available for use with this equipment.

Suitable tuning equipment is provided in the radio transmitter to permit operation into a wide range of antennas over most of the frequency range. Antenna Tuning Unit BC-306-A may be used to extend the range of antenna tuning for frequencies between 150 and 800 kilocycles.

1. TU-5-B	1500–3000 kc	5. TU-9-B	7700–10,000 kc
2. TU-6-B	3000–4500 kc	6. TU-10-B	10,000–12,500 kc
3. TU-7-B	4500–6200 kc	7. TU-22-B	350–650 kc
4. TU-8-B	6200–7700 kc	8. TU-26-B	200–500 kc

Dynamotor Unit PE-73-C furnishes the power required by the radio transmitter and operates from a 24/28 volt storage battery or other direct-current source used in aircraft.

SECTION II

INSTALLATION

2. GENERAL

Radio Transmitter BC-375-D and associated equipment are part of aircraft radio sets. Installation conditions vary widely, and no detailed single set of installation instructions can be given in this book. However, separate instructions are furnished for each radio set and only such general instructions as can be followed in all installations are given in the following paragraphs.

The requirements for shielding and bonding of cords in aircraft installations are very rigid, so that difficulties with extraneous pick-up from the radio receiver side tone and radio frequency from the power supply will be minimized.

3. RADIO TRANSMITTER BC-375-D (Includes Mounting FT-151-A)

The radio transmitter outline dimensions and weights are shown in Fig. 3.

The radio transmitter should be located in relation to its associated equipment so that dynamotor and antenna leads will be of minimum length. Two types of shock-absorber mountings are available for use with the radio transmitter: Mounting FT-151-A is a tray-type and is part of the Radio Transmitter BC-375-D. Mounting FT-115-B is a disposable-type. The tray-type mounting, to which the radio transmitter is attached by four snap-slide catches, is normally used. The disposable mounting is sometimes added near the top of the radio transmitter to prevent swaying. Mounting FT-115-B consists of a rubber button in a steel shell which may be attached to the top, bottom, or sides of the radio transmitter. Certain of the radio transmitter-cover fastening screws have been placed so as to allow attachment of this mounting.

The radio transmitter should not be mounted closer than two inches from a wall, and in aircraft and vehicular installations it is desirable that Mounting FT-115-B be added at the top of the radio transmitter to prevent excessive swaying. The power cords should not be fastened nearer than 18 inches from the radio transmitter. This precaution prevents vibration from being transmitted to the unit through the cords. It is important that sufficient space be allowed in the front of the radio transmitter to facilitate replacement of tubes, removal of transmitter tuning units, and the making of tuning adjustments. After installation has been completed and tested, the snap-slide catches should be securely safety-wired at the places provided.

4. DYNAMOTOR UNIT PE-73-C

The dynamotor unit should be mounted in an accessible position to allow access to the relay-fuse box, keeping in mind that the length of the leads from the battery to the dynamotor unit must be as short as practicable. This unit when operated in conjunction with Radio Transmitter BC-375-D draws from 20 to 30 amperes. No. 6 Awg or larger conductor should therefore be used for these leads in order to keep the voltage drop at a minimum. Mounting FT-107 should be securely attached so that the dynamotor unit cannot be torn loose by acceleration, vibration or shock.

After the dynamotor unit is clamped securely to Mounting FT-107 by means of the four snap-slide catches, Plugs PL-59 and PL-61 of the applicable cords should be plugged in Sockets SO-39 and SO-41, respectively on the dynamotor unit. The primary leads from the battery should then be clamped securely to the proper binding posts on the dynamotor unit terminal board.

5. CORDS

The cords to be used with the various radio sets are listed in the parts lists for same. Schematic diagram (Fig. 1) shows the necessary cording for the Radio Transmitter BC-375-D. Plug PL-64 and Socket SO-44 contain the necessary interconnections for the radio receiver and transmitter control.

6. ANTENNAS

Because of the wide variety of antennas in the radio sets of which Radio Transmitter BC-375-D is a part, no specific details will be given for antenna installations. However, the following general precautions should be observed:

1. The antenna and ground leads should be made as short as possible, except where the length of lead-in is definitely determined by the placement of radio set and antenna.

2. Antenna leads should be insulated to withstand radio-frequency potentials as high as 5000 volts.

3. Antenna leads should be so placed that operating personnel will not come in contact with them during normal operation of the equipment. Points accessible to personnel should be covered with Isolantite beads.

4. Ground connections should have as low resistance as possible. In aircraft installations the ground path should be well bonded. The GND post should always be connected to the ground system by a short lead, allowing, of course, for flexure due to vibration and shock. A link will be required between posts LOAD A and LOAD B when Antenna Tuning Unit BC-306-A is not used.

5. Antenna leads between the antenna and radio transmitter and between the radio transmitter and the radio receiver should be located as far as possible from any primary wiring of the airplane. This applies especially to the wiring to the dynamotor unit and is necessary in order to decrease the pick-up of electrical interference by the antenna circuit wiring.

7. ANTENNA TUNING UNIT BC-306-A

This tuning unit is provided with Mounting FT-142. It should be mounted so that the tuning controls will be accessible during operation. It is desirable that the length of leads between the radio transmitter and the antenna tuning unit be kept to a minimum and that the leads be well insulated.

Terminals A-TRANS and B-ANT on the antenna tuning unit are connected to LOADING TERMINALS A and B respectively on the radio transmitter when operation is with one of the low-frequency transmitter tuning units (Transmitter Tuning Unit TU-22-B or TU-26-B). However, at high altitudes (above 15,000 ft.) and frequencies below approximately 400 kc, better operation may be obtained by connecting terminal A-TRANS on the antenna tuning unit to the antenna post on the radio transmitter; placing a jumper between LOADING TERMINALS A and B on the radio transmitter; and connecting the antenna to terminal B-ANT on the antenna tuning unit. This alternate connection should be used only if it is necessary to reduce the r-f voltages at the radio transmitter because of high altitude flashovers. The sensitivity of the radio receiver may be reduced slightly. The post marked GND on the antenna tuning unit should always be connected to the radio transmitter ground.

8. REEL RL-30-B AND CONNECTOR CLAMP MC-163

The reel should be mounted in such a position that the crank is readily accessible and the counter is visible. In order to prevent excessive "piling" when the wire is being reeled in, the reel should be mounted at least six inches above the fairlead and so placed that the point at which the antenna wire leaves the spool is in line with the axis of the fairlead; that is, for best operation there should be no bends in the antenna wire between the point where it leaves the reel and the far end of the fairlead. The four mounting bolts can be inserted in the reel base through the hole provided in the web of the spool. Unless the mounting screws themselves are grounded, a heavy grounding wire or strap could be clamped under the nut of one of the mounting screws for the purpose of thoroughly grounding all metal parts of the reel.

To fasten the antenna wire to the bottom of the spool channel it is first necessary to remove the spool cover by withdrawing it forward over the spool. This can best be done by placing the fingers of both hands on opposite sides of the cover and pressing on the spool with the thumbs. The end of the wire should be looped under the anchor pin in the spool hub and then twisted around the wire proper a few times. The twisted loop should then be placed in the groove and all of the wire wound on the spool by turning the crank in a clockwise direction. At this point the cover should be replaced by passing the wire through the slot opposite the wire opening and pushing the cover over the spool until it rests against the flange on the back plate. The cover should now be rotated so that the wire from the fairlead to the spool will not rub the edges of the wire opening in the cover either when the spool is full or nearly empty. The counter should now be set to zero. This should be done each time the reel is used in order to reduce the error in the reading caused by irregularities in winding.

Electrical connection to the radio transmitter is made by means of Connector Clamp MC-163, the installation of which is as follows:

a. Remove the brass bushing from Connector Clamp MC-163 by loosening screw in top of cover

and fasten the antenna lead from the radio transmitter to this bushing by means of the screw provided.

b. Replace the bushing in cover and place the connector over the top of the fairlead, clamping it into place by means of the screw in the side of the cover.

c. Wind the desired amount of Wire W-106 or W-106-A on the spool and feed the free end through the connector clamp and fairlead until it touches the ground below the airplane.

d. Connect the free end of the wire to the cable loop on the Weight WT-7-A or WT-7-B. Considerable care should be taken in making the connection between the antenna wire and the weight cable in order that the joint will run smoothly through the connector clamp when the antenna is being let out or reeled in. The loop formed in the antenna wire should be as small as practicable and the section where the antenna wire is twisted back upon itself should be tapered and made as short as a safe joint will permit.

Wind up the antenna wire in the reel until the Weight WT-7-A or WT-7-B rests securely in the fairlead socket. Let out and reel in approximately ten feet of the antenna several times (have someone pull lightly on the weight to keep the antenna wire tight) to insure that the connector clamp is working properly and that the joint between the antenna wire and weight cable runs smoothly through the clamp.

Fairlead Extension F-9 is used when the standard Fairlead F-8 is not long enough. It consists of Coupling MC-161 and a 36-inch length of standard phenolic tubing of the same cross section as the tube of Fairlead F-8. The extension is installed by slipping Coupling MC-161 over the top of the fairlead tube so that it covers approximately 3 inches of the tube and then securing it in place by means of one of the clamps provided. The tubing may then be clamped into the coupling by means of the remaining clamp. This tubing may be cut to fit a particular installation or more than one extension may be used if required.

9. INTERCONNECTION WITH THE RADIO RECEIVER IN AIRCRAFT

It is necessary, in order to minimize receiver noise, that the cord shields be well grounded and so supported that they cannot rub on other cords or metal surfaces. In order that the radio receiver used be coordinated with the radio transmitter, the receiver control wires should be connected to terminals 21 and 22 of Plug PL-64. These points are normally closed but are opened when the key is closed and the radio transmitter starts functioning.

SECTION III

PREPARATION FOR USE

10. GENERAL

After installation and before the equipment is put into operation, the circuits of all cords and external wiring should be checked to insure compliance with the circuit diagram and the applicable interconnection diagram. This circuit check should be made with all plugs removed from the sockets in the radio transmitter and power unit to determine that all cord and junction box connections are made as indicated on the diagrams. A voltmeter and battery may be used for this purpose. The plugs should be replaced in their respective sockets after this check.

11. RADIO TRANSMITTER BC-375-D

The following procedure is recommended for preparing the radio transmitter for use after installation.

a. Remove Plug PL-59 from the power unit or dynamotor unit and cover its socket with a Socket Cap M-164-A.

b. Remove the tube compartment shielding cover and insert the tubes. From the front of the radio transmitter, progressing from left to right, the tubes are as follows:

Tube VT-25—Speech Amplifier
Tube VT-4-C—Master Oscillator
Tube VT-4-C—Power Amplifier
Tube VT-4-C—Modulator
Tube VT-4-C—Modulator

c. D-c Filament Supply: (Note: This equipment is not designed for alternating-current operation.)

(1). Remove all links from the filament resistor connection board.

(2). Assuming that the primary source voltage is 28 V. (the terminal voltage of a 24-volt storage battery under charge), place the 24 V/28 V switch in the tube compartment in the 28-volt position.

(3). Set the transmitter signal switch on CW and the filament voltmeter switch on CW FIL.

(4). Place the OFF-ON switch in the ON position. This should start the dynamotor unit and apply filament supply potential to the radio transmitter, but not to the tubes. Connect link between adjacent studs on the 28 V and CW FILAMENT rows. The CW filaments will light and the filament voltmeter read. Repeat this until the two studs are found that when connected will cause

the filament voltmeter to read 10 volts. Then place the OFF-ON switch in the OFF position and connect a link between the two studs just selected.

(5). Set the radio transmitter signal switch on VOICE and the filament voltmeter switch on MOD. FIL. Repeat the operation of (4) for the 28 V and MOD. FILAMENT rows of studs.

(6). Again place the OFF-ON switch in the ON position. Set the filament voltmeter switch on CW FIL. (signal switch on VOICE). The CW filament voltage will now be less than 10 volts. In the same manner, connect between the adjacent studs of the COMP and CW FILAMENT rows until the filament voltmeter again reads slightly over 10 volts. The OFF-ON switch may then be placed in the OFF position and this link fastened in the proper place.

(7). Cut off the charging generator, place the 24 V/28 V switch in the 24-volt position and in a similar manner to the preceding select the proper studs on the 24 V and CW FILAMENT rows and the 24 V and MOD. FILAMENT rows so that the filament voltmeter will indicate 10 volts in either position. As now adjusted the filament voltages will not require further adjustment unless the cable lengths or charging rates are changed. Ordinarily, in aircraft installations, a battery-charging generator is used at all times. The 24 V/28 V switch should accordingly be placed in the 28-volt position. If it is desired to check the operation of the radio equipment when the charging generator is below operating speed, this switch should be changed to the 24-volt position since operation at low voltage will reduce the life of the tubes.

d. Replace Plug PL-59 in the dynamotor unit or power unit.

NOTE: It will be noted that the filament voltmeter will show from 0.3 volt to 0.5 volt rise when the transmitter key is closed and plate current is being drawn.

This is a normal condition of the radio transmitter circuits and should be ignored, providing the above filament adjustment has been made correctly.

12. OPERATION AT HIGH ALTITUDE

Radio Transmitter BC-375-D and associated equipment may be expected to give satisfactory service on CW at all altitudes up to 27,000 feet. On TONE and VOICE, however, insulation breakdown may be experienced with Transmitter Tuning Unit TU-8-B (6200–7700 KC) above 25,000 feet and with Tuning Unit TU-9-B (7700–10,000 KC) above 19,000 feet. These altitude limitations may be exceeded slightly by care in tuning and by carefully guarding against accumulation of dust and other foreign matter in the equipment. Complete assurance of effective operation between 6200 and 10,000 kilocycles at altitudes between 19,000 and 27,000 feet may be had on CW alone. Transmitter Tuning Units TU-22-B and TU-26-B may be expected to give satisfactory service at all altitudes up to 15,000 feet.

13. DYNAMOTOR UNIT PE-73-C

Before being used for the first time, it is recommended that the end bells of the dynamotor unit be removed to make certain that the armature rotates freely in its bearings, and a check should be made to determine how much time has elapsed since the dynamotor unit was last serviced. If this time exceeds five months, follow lubrication instructions appearing in this book. Do not lubricate more often or add more lubricant than is specified in those instructions.

The voltage at the input terminals of the dynamotor unit must be 28 volts in order to obtain rated power output from the radio transmitting equipment.

SECTION IV
OPERATION

14. RADIO TRANSMITTER ADJUSTMENT

WARNING: Operation of this equipment involves the use of high voltages which are dangerous to life. Operating personnel must at all times observe all safety regulations. Do not change tubes or make adjustments inside equipment with high voltage supply on. Do not complete or maintain any connection between radio transmitter and dynamotor unit unless all shields on the transmitter are in place.

Assuming that the installation and preliminary adjustments have been made in accordance with SECTIONS II and III, the following operating procedure is recommended. Some of these adjustments need be made only at the time of installation.

Under no conditions should any of the switches on the radio transmitter or tuning unit be changed with the key or microphone button depressed. Insure that all switches position correctly; do not attempt to leave switches between points. Failure to observe this procedure causes undue arcing of the switch and severe strain on the vacuum tubes.

a. CW Operation: Select the transmitter tuning unit for the desired frequency. CW operation may then be obtained as follows:

(1). Place the signal switch on CW.

(2). From the calibration chart on the front of the transmitter tuning unit, set the band change switch A, the M.O. TUNING Control, and the P.A. TUNING Control for the desired frequency, and set the ANT. COUPLING SWITCH D on Point 1. (It should be remembered that the band change switch does not appear on Transmitter Tuning Units TU-7-B to TU-10-B inclusive.)

(3). Place the OFF-ON switch on the ON position. The dynamotor should now start and the m-o and p-a filaments will light. In case repeated failures of Fuse FU-22 are encountered and if such failures persist after compliance with instructions pertaining to Dynamotor Unit PE-73-C, it is recommended that Fuse FU-22 be removed from the relay-fuse box and one extra Fuse Link M-168 inserted in the fuse cartridge. Fuse FU-22 will then have two fuse links in it and should be replaced in the relay-fuse box of the dynamotor unit. In no case should the use of more than two fuse links be attempted.

(4) Press the test key or the transmitting key. The vacuum tubes will now draw plate current as indicated by the TOTAL PLATE CURRENT METER. The p-a tuning should be checked immediately for resonance by varying the control slightly until a minimum total plate current is indicated. When the p-a circuit is properly resonated, the total plate current will be from 80 to 110 milliamperes.

(5) The antenna should next be tuned to resonance. Because a wide variety of antennas is possible, no specific instructions for antenna tuning are given other than instructions to effect antenna resonance by means of the controls provided on the transmitter, and on the antenna tuning unit whenever the latter is in use. The subject of ANTENNA ADJUSTMENTS (paragraph 15) is considered more in detail elsewhere in this instruction book, and should be referred to in preparation for operation of the equipment.

Antenna resonance is indicated by a reading of current on the ANT. CURRENT meter and by an increase in total plate current. The increase in plate current is the more sensitive indication of approaching antenna resonance. When the antenna is tuned to resonance, the total plate current reading will be somewhat higher than the off-resonance value. If the plate current is below 200 to 220 milliamperes, the coupling to the antenna should be increased by placing control D on a higher point and the antenna circuit retuned. When finally adjusted, the total plate current should read from 200 to 220 milliamperes. If necessary, detune the antenna circuit slightly, keeping the p-a dial C in resonance to keep within the plate current limits.

(6). The equipment is now delivering rated power output, and the transmission may be carried on by operating the transmitting key. In order to shut down the equipment, it is necessary only to place the OFF-ON switch in the OFF position.

b. Voice Operation: Assuming that the equipment has been placed in operation on CW, the following procedure is recommended for obtaining voice operation. Note the value of total plate current for CW operation. Then place the signal switch in the VOICE position and, by means of the MOD. BIAS adjustment in the tube compartment, adjust until the total plate current with the microphone switch depressed is approximately 20 to 35 milliamperes higher than for CW. The modulator tubes are now biased nearly to cutoff for proper Class B operation, and radiophone communication may be carried on by speaking into the microphone. It will be noted that the total plate current increases when the microphone is spoken into. This increase is due to current drawn by the modulator tubes. With sustained normal level of speech impressed on the microphone, the plate current should rise to an average of 300 milliamperes. If this value is not obtained, the INPUT LEVEL control in the tube compartment can be adjusted until the proper amount of modulation, as indicated by the correct plate current, is obtained.

c. Speech-amplifier Bias: The correct speech-amplifier bias will usually be found between 6.0 and 7.5 on the bias adjustment dial. Settings in this range will normally give the proper speech-amplifier plate current and optimum side-tone frequency on all tuning units.

d. Tone Operation: After the equipment has been adjusted for VOICE operation, it is necessary only to place the signal switch on TONE for proper tone telegraph operation. The total plate current on TONE will usually be between 300 and 350 milliamperes.

e. Side Tone in Aircraft Set: If the radio receiver circuits have been properly co-ordinated with the radio transmitter, the receiver control circuit will operate each time the transmitting key or microphone switch is closed, and the transmitter side tone will be supplied to the headset. When the key or the switch is opened the receiver again becomes operative, thus allowing break-in operation. The SIDE-TONE level control located in the tube compartment, is used to adjust side tone to a suitable value for any particular installation. It will be noted that a higher level is desirable on voice position than on the CW and TONE positions.

f. Calibration Reset: Due to necessary manufacturing tolerances, the inter-electrode capacity of a vacuum tube varies between limits fixed for each particular type of tube. Since the tube capacity is an appreciable part of any master-oscillator circuit, it is impossible to make up a calibration chart which will be exactly accurate for all tubes whose capacities are within the allowable limits. For this reason Radio Transmitter BC-375-D is provided with a calibration reset capacitor which enables the operator to reset the radio transmitter frequency to correspond with the calibration chart when the set is first placed in operation and thereafter whenever the master-oscillator tube is changed. A heterodyne frequency meter or other standard of frequency is required. The procedure is as follows:

(1). Allow radio transmitter to warm. The operator will obtain the most accurate results by allowing the radio transmitter to "warm up" on key locked CW for a period of at least 20 to 30 minutes before setting the calibration reset capacitor or checking the calibrated transmitter frequency.

(2). With the transmitter tuning unit for the highest working frequency placed in the radio transmitter, tune the transmitter for CW operation on one of the calibrated frequencies at the high frequency end of the band. (Approach the calibrated point by proceeding from a lower dial reading to a higher one.)

(3). Place the frequency meter in operation and adjust it to the frequency indicated on the transmitter calibration in accordance with the operating instructions and calibration chart furnished with the frequency meter. The calibration accuracy of this frequency meter should be 0.01 per cent, or better.

(4). Open the calibration reset port, located on the front panel, between the TEST KEY and TONE-CW-VOICE switch, insert a screwdriver, and rotate the calibration reset capacitor until the transmitter frequency coincides with that of the frequency meter or standard.

(5) Close the calibration reset port.

The transmitter calibration is now reset for any tuning unit of the same order number and serial number as the radio transmitter and the accuracy of calibration will be within 0.05 per cent plus the accuracy of the standard. The calibration must be checked in this manner each time the m-o tube is changed.

15. ANTENNA ADJUSTMENTS

The antenna is, in general, a system of conductors which, when excited by a radio-frequency voltage, sets up an electromagnetic and electrostatic field causing a component of this field to travel away from the antenna with the velocity of light.

The radiation characteristics of antennas, directivity, and radiation efficiencies are determined by their physical shape and location with respect to other bodies. In aircraft, since there is no wide latitude in physical design of fixed antennas, the problem becomes mainly one of determining the best methods of operating available designs.

It is necessary first to determine how the antenna impedances vary at the operating frequencies in order that the loading facilities may be properly used. The reactance of an antenna may be approximated from the theory of transmission lines in which uniformly distributed inductance and capacity are assumed, resistance and insulator leakage being neglected.

Selecting a certain length of antenna and plotting its reactance variation with frequency, we obtain repeating cotangent curves. It may be seen that at certain frequencies the reactance becomes zero. Under these conditions, the antenna is "resonant," analogous to a simple-series circuit turned to resonance.

It may be noted that the "series" resonant points occur at all odd multiples of the first resonant frequency, which is called the fundamental frequency. The fundamental frequency, the third harmonic, and the fifth harmonic, all points of zero reactance, correspond to a voltage distribution along a simple vertical wire of "quarter-wave," "three-quarters wave," and "five-quarters wave." Antennas of this type, operated at zero or low reactances, are commonly called "current fed"; that is, they require low driving voltages for their operation.

At even multiples of the fundamental frequency, it may be seen that the antenna reactance is very high. Operation at the second and fourth harmonics corresponds to "half-wave" and "full-wave" operation. Under these conditions, antennas are "voltage fed"; that is, they require high driving voltages.

The resistance component of the antenna impedance is made of two parts: radiation resistance which represents the radiation of power or waves away from the antenna and which is productive of a useful result; and loss resistance which is a combination of losses due to conductor and ground resistance, and to dielectric hysteresis. Loss resistance performs no useful function and every effort should be made to maintain it very small in comparison with the radiation resistance. The efficiency of an antenna with respect to radiation of power may be expressed as the ratio of radiation resistance to total antenna resistance.

Antenna resistance varies over wide limits with frequency. The resistance values approach very high values at the even harmonics, and minimum values

at odd harmonics. It is thus seen that the operation of a radio transmitter over a wide frequency band requires that the radio transmitter be capable of providing a considerable range of output voltages. This is accomplished in each transmitter tuning unit by a six-point ANT. COUPLING SWITCH, D. In order that the voltage range required be kept a minimum, antennas are usually "resonated"; that is, they are series tuned by either inductance or capacity as may be necessary so that the required output voltage range depends only on the antenna resistance variation over the desired frequency range. Transmitter Tuning Unit TU-22-B has a series capacitor in use when Control D is on 6 for resonating when operating into a pure resistance approximating 40 ohms. Do not operate Tap 6 into low resistances as the large amount of resonant current will overload this series capacitor.

When operating antennas at frequencies lower than their fundamental or odd harmonics, they appear to the antenna tuning equipment as a capacity in series with a resistance. In order to balance out this capacitive reactance, it is necessary to load the antenna by means of an inductance, the reactance of which is made equal to that of the apparent antenna capacity. For operation of antennas at frequencies higher than their fundamental and odd harmonics, the converse is true, a capacity in series with the antenna being necessary in order to balance the apparent antenna inductive reactance.

In most cases, except where 3/4- and 5/4-wave trailing wires are used for high frequencies, antenna operation will be around the fundamental frequency.

In general, it may be said that if antennas are operated so that their effective length is an appreciable percentage of the operating wavelength, they will have marked directive properties. This corresponds to operation near to and higher than the fundamental frequency. When antennas are operated at frequencies much lower than the fundamental, the ratio of radiation to total resistance is less favorable, but the directive properties, are not nearly so evident. The fundamental frequency of an antenna depends mainly on its effective length including the ground lead. Fundamental frequencies in the range of 2500–7000 kilocycles will be the most common with the usual types of fixed antennas, while fundamentals as low as 1500 kilocycles will be obtained with 200-foot trailing-wire antennas.

The antenna tuning equipment in the radio transmitter is designed to feed antennas at any frequency from 800 to 12,500 kilocycles. Over this band of frequencies it is necessary to feed antennas at, above and below their fundamental frequencies. Therefore, the circuit and circuit constants are so selected as to permit of both current and voltage feed. A rotating inductor and a tapped inductance provide the inductive reactance variation. A variable capacitor provides the variation in capacitive reactance and also serves as a coupling impedance for voltage feed. Controls governing the variation in inductive or capacitive reactance are so arranged that inductance or capacitance is increased with increase in dial reading.

With the ANT. CIRCUIT SWITCH, N, on position 1, the radio transmitter works into a simple series resonant circuit, in which the high voltage built up across the antenna tuning capacitor is used to "voltage feed" the antenna. This circuit is generally used for high frequencies and fairly long fixed antennas. The antenna feed circuit is maintained at resonance by means of ANT. IND. TUNING, M, while the voltage fed to the antenna is varied by means of ANT. CAP. TUNING, O, and ANT. COUPLING SWITCH, D. Feed circuit resonance is indicated by the ANT. CURRENT meter. The current in the feed circuit is adjusted by control D and should not exceed 6 amperes. The step-by-step tuning procedure is as follows:

(1) Set control O at some arbitrary scale reading.

(2) Resonate circuit by means of control M for a maximum reading on ANT. CURRENT meter.

(3) Adjust control D so that antenna ammeter reads below 6 amperes.

(4) Re-resonate circuit as in 2.

Repeat the above procedure until the proper loading (200–220 ma on CW) is indicated on the plate ammeter. The lower the dial reading on control M and the lower the reading on the ANT. CURRENT meter that it is possible to obtain at a given frequency, the more power will actually be delivered to a given antenna. The lower the reading on control M and the lower the ANT. CURRENT readings, the less the tuning circuit losses and thus the more useful power is delivered to the antenna for radiation purposes.

With ANT. CIRCUIT SWITCH, N, on position 2, the radio transmitter works into a series resonant circuit where the antenna is "current fed." The antenna circuit is resonated by means of ANT. IND. TUNING, M, and ANT. CAP. TUNING, O, as indicated by the ANT. CURRENT meter. This circuit is used generally for operation near the fundamental frequency of the antenna.

With control N on position 3, the radio transmitter works into a series resonant circuit providing "current feed" and inductive loading. The antenna circuit is resonated by means of a continuously variable rotating inductor, control M. This circuit is used for operation below the fundamental frequency of the antenna.

With control N on position 4, the antenna circuit is identical with that obtained on position 3 except that an additional tapped inductance, controlled by ANT. IND. SWITCH, P, is added in series with the rotating inductor. This circuit is used when the

operating frequency is relatively far below the fundamental frequency of the antenna.

It is recommended that the operator check the possible resonance of coil, item 1170 of Fig. 1, at operating frequencies above 4500 kilocycles. Although this coil is not connected in the antenna circuit, the inherent capacity coupling may cause absorption of useful radio-frequency power. Absorption may be easily determined by placing control switch P at several points while watching the antenna current. Control P must not be allowed to remain at a point which indicates a decrease in antenna current. In general, it will be found that no difficulty will occur if the following points are used.

Transmitting Tuning Unit	P Switch Position
TU-7-B	2
TU-8-B	5
TU-9-B	5
TU-10-B	5

The antenna resonance is then made in the usual manner using controls M, N, and possibly O.

For operation in the frequency range of 150 to 800 kilocycles, the externally connected Antenna Tuning Unit BC-306-A is used. This unit contains the necessary inductive reactance to resonate specified antennas at frequencies well below their fundamental. The variation in inductive reactance is provided by the ANTENNA VARIOMETER SWITCH, control E, and the ANTENNA VARIOMETER, control F. The proper connections are described in SECTION II, INSTALLATION. In general, it will be necessary to use the Antenna Tuning Unit BC-306-A with Transmitter Tuning Units TU-22-B and TU-26-B. The antenna loading equipment contained in the radio transmitter will resonate a 400 micromicrofarad antenna to approximately 650 kilocycles. Therefore when the minimum inductance is reached on the Antenna Tuning Unit BC-306-A (E=2, F=0), place control E in position 1 which disconnects this unit. Proceed to resonate the antenna circuit with control N on 4. Control M is the continuously variable inductance between inductance steps on control P.

Under some conditions it may be found that one coupling tap will not give sufficient loading while the next higher tap will give overloading of the transmitter. In this case use the higher coupling tap by slightly detuning the antenna circuit and keeping the p-a dial C tuned to a minimum plate current until the normal transmitter loading of 210 to 220 milliamperes total plate current is obtained.

16. DYNAMOTOR UNIT PE-73-C

Starting and stopping of the dynamotor unit is controlled remotely by the OFF-ON switch at the Radio Transmitter BC-375-D. No adjustments are required or provided on the dynamotor unit.

When operated at full-rated load continuously for ½ hour the temperature rise of the dynamotor will not exceed 55 degrees Centigrade. However, if the dynamotor is operated for a greater length of time, even at lighter loads, without being allowed to cool off, its temperature will continue to increase and will ultimately reach values which are injurious to the insulation and may even burn out the windings. This also applies to the starting relay. If it is desired to operate the dynamotor unit continuously at full load for a period greater than ½ hour (such as for testing purposes in the laboratory), the end bells of the dynamotor and the cover of the relay-fuse box should first be removed. The dynamotor unit can then be operated at rated load continuously for any period of time without injurious heating. Care should be exercised to place guards around the dynamotor unit when operated in this manner so that the operators cannot come in contact with exposed high voltages. When operated in conjunction with the transmitter, the dynamotor operates at practically zero load unless the key or microphone switch is closed. Continuous operation under this condition will not result in overheating although the transmitter should be turned off whenever possible between the periods of transmission.

17. REEL RL-30-B

Braking, locking and winding operations are controlled from the crank on the reel. Normally the reel is in the locked position such that the wire will not unwind from the spool. Reeling-in is accomplished by rotating the crank in a clockwise direction, as indicated by the direction arrow Wind on the nameplate at the center of the reel spool. A ratchet mechanism on the spool prevents the wire from unreeling when the crank is released. By rotating the crank in a counterclockwise direction the braking mechanism is released, thereby permitting the wire to be reeled out. Braking force decreases gradually as the handle is rotated through approximately the first 40 degrees of its motion. Beyond this point, and up to the extreme limit of its motion the brake is completely released and the spool is free to spin. The speed of unwinding can be readily controlled by regulating the braking effect with the crank. A spring return on the crank automatically resets the brake to the normal or locked position when it is released.

Tuning the antenna by adjusting its length should be accomplished by allowing slightly more wire than is necessary to run from the reel and then reeling in slowly to obtain the proper length by observing the resonant condition. During the reeling-out operation, care should be taken that all of the wire is not unreeled. The speed with which the reeling

takes place would be sufficient to snap the wire if it reached its ultimate length, causing a loss of both the weight and wire.

When unreeling wire, never allow the crank to snap into the locking position when the spool is rotating rapidly. The sudden stop which would result may break the antenna wire and place undue stress on the reel mechanism.

The following table gives the approximate antenna length for various frequencies as well as the approximate counter reading when 250 feet of Wire W-106 or W-106-A is wound on the spool.

KC	1/4 Wave		3/4 Wave	
	Length (Ft)	Counter Reading	Length (Ft)	Counter Reading
2000	123	108		
3000	82	72		
4000	62	54		
5000	49	44	147	130
6000	41	36	123	108
7000	35	30	105	92
8000	31	28	93	82
9000	27	24	81	72
10000	24	22	73	64

18. OPERATING ROUTINE

The operating routine and type of transmission to be used will be governed by tactical requirements. The following recommendations are given, however, to assist in routine operation of the equipments:

a. Complete equipment operation should be checked before the start of any mission.

b. Make certain that spare fuseholders are filled with good fuses, and that spare tubes (if carried) are in good condition.

c. The transmission range of the equipment on CW is considerably greater than on VOICE. If distance, atmospheric noise, etc., make VOICE communication difficult, changing to TONE or CW will probably improve communication.

d. In case of failure of one or two Tubes VT-4-C with no spares on hand, CW communication can be carried on by inserting the good tubes in the m-o and p-a sockets. CW operation can also be maintained when the Tube VT-25 is removed, although no side tone will be supplied in this event. Note that the radio-frequency and audio-frequency tubes are connected in series parallel. If one tube is removed, another filament will go out.

19. SUMMARY COVERING NORMAL OPERATION

Although the normal operation of this equipment is extremely simple after the correct installation has been made, it is well to study the proper sequence of various equipment procedures as summarized in the following paragraphs. It is assumed that the installation has been tested and all circuits are normal.

Do not change any switches with the key or microphone button depressed.

a. To Start the Equipment: Place the OFF-ON switch at ON. The dynamotor unit will start and the filaments will light. Unless the TONE and VOICE emissions have been adjusted, start up initially on CW and adjust for the desired type of emission as given below. To control carrier depress the key.

b. To Stop the Equipment: Open the key then place the OFF-ON switch at OFF.

c. To Change Frequencies: Select the required transmitter tuning unit and place in the radio transmitter. Place the M.O. TUNING control, BAND CHANGE SWITCH (if any) and the P.A. TUNING control on the desired calibrated frequency as given on the calibration chart. Place the emission switch on CW, start up the radio transmitter and immediately check the P.A. TUNING dial for minimum plate current as indicated on the TOTAL PLATE CURRENT meter. Resonate the antenna circuit and load to a total plate current of 210 to 220 milliamperes with the p-a dial resonated, i.e., always tuned to a minimum plate current. Proceed to key the carrier on CW or select the other types of emission as given below.

d. To Select Any Available Type of Emission: Start up the radio transmitter and tune for CW transmission first as given in paragraph 19*c*. then, open the key and place the TONE-CW-VOICE switch on VOICE. Remove the tube shield and adjust the MOD. BIAS control after key is depressed, until the total plate current reads 20 to 35 milliamperes above the CW value. Proceed to control carrier by microphone button and modulate by voice, adjust the side-tone signal to the desired level by means of the SIDE-TONE control located in the tube compartment. Adjust the voice level by the INPUT LEVEL control so the total plate current reaches 300 to 350 milliamperes on peaks of sustained voice.

For tone transmission the operator must always adjust transmitter for VOICE, first. Then open the key, place the selector switch on TONE and proceed to key carrier as in CW.

e. To Increase Power Output: Go to a higher number on the ANT. COUPLING SWITCH D at the same time keeping the P.A. TUNING dial C and the antenna circuit in resonance. Power may be increased until a CW plate current of 220 ma at 28 volts input is reached.

To Decrease Power Output: Go to a lower number on ANT. COUPLING SWITCH D, at the same time keeping the P.A. TUNING dial C and the antenna circuit in resonance.

It should be noted that the CW power output may be increased or decreased in the above manner from the value of plate current with the antenna circuit open to the full load rating of 220 milliamperes. However, the TONE and VOICE carrier powers SHOULD NOT BE INCREASED OR DECREASED. Unless the TONE and VOICE carriers are adjusted as given in paragraph 19*d.*, distortion will result. Also, the misadjustment may cause arcovers which would damage the equipment.

f. To Reset to the Calibration Chart, after changing of the m-o tube, etc.: Start the radio transmitter on the highest frequency tuning unit available. Warm up the radio transmitter on CW key locked for 10 to 20 minutes. The tube shield must be in place. Listen to the calibrated frequency on a suitable accurate heterodyne frequency meter and adjust the radio transmitter to zero beat by means of a screw driver inserted into the reset port on the left front radio transmitter panel. This should bring the radio transmitter back to calibration and all other frequencies should be within 0.05 per cent. For greater accuracies reset as above to the exact frequency desired.

SECTION V
MAINTENANCE AND REPAIR

20. INSPECTION

A thorough periodical inspection of the complete installation at least once every 50 hours of operation will materially aid in the maintenance of uninterrupted performance. The following inspection is recommended:

a. Determine that the storage battery is at the proper gravity and that the charging generator and regulator are adjusted so as to keep the battery fully charged.

b. Clean accumulated dust and dirt from all units. Use an air hose or bellows, paying particular attention to the loading coil, item 1170, in the antenna compartment of the radio transmitter. At this time inspect the rotating coil, in this compartment. The winding should be thoroughly cleaned with carbon tetrachloride (Carbona or equal) and a clean cloth.

c. Make certain that all safety wiring is in place, that all mounting brackets and supports are rigidly fastened and that all nuts and machine screws are supplied with lockwashers and are tight.

d. Determine that no cords have broken shielding and that all grounding and bonding is in place.

e. Inspect plugs for proper fit and plug sockets for compressed pin springs. Compressed pin springs, which have taken a permanent set, can be restored by a light hammer blow on the end of the pin.

f. Make certain that all fuses are held tightly in their clips. A loosely held fuse should be removed and the clips bent with the fingers until they grip the fuse tightly. The clips and fuse ends should be kept clean and the contact surfaces bright.

g. Antennas should be inspected for broken or frayed leads, and insulators should be wiped clean. Be sure that antenna leads have not been bent close to metal frameworks where high antenna voltages might cause sparkovers.

h. Inspect keys and microphones for broken cords and deformed plugs.

i. Inspect dynamotor brushes for length and broken pigtail leads. Detailed instructions on care of brushes are given herein.

j. Inspect both dynamotor commutators for cleanliness and excessive wear. Information on care of commutators is given in these instructions.

k. Rotate the dynamotor armature by hand to make certain it turns freely and is not rubbing against the field poles or leads. When all four brushes are removed, the armature should spin freely on its bearings. Refer to detailed information on dynamotor bearings.

21. LUBRICATION

a. Materials: The lubrication of the equipment involves the use of three lubricants and one cleaning solvent. These are:

(1) Light Oil: A high grade, low pour test, mineral oil with viscosity rating SAE 10.

(2) Light Oil: A high grade, low pour test, mineral oil with viscosity rating SAE 20.

(3) Grease: Use only high temperature ball bearing grease such as Grade 295 Air Corps Specification No. 3560. "Refined Calol Grease" as manufactured by the New Departure Manufacturing Company, Bristol, Connecticut, or New York and New Jersey Lubricant No. 1572 meet the requirements of the above specification. "Calol" is a stiff, pale yellow, high flow point, sodium base grease which has been developed particularly for ball bearing applications of this nature. Do not use unauthorized greases as these may melt out at high temperatures or may oxidize rapidly and become gummy when packed in the bearings.

4. Cleaning Solvent: Carbon tetrachloride (Carbona or equal) is strongly recommended.

b. Periodic Lubrication Routine

Dynamotor Unit PE-73-C: Under normal operating conditions, the dynamotor bearings should be lubricated in accordance with the following schedule:

(1) After every 1000 hours of operation or at intervals of six months, add 3 drops of SAE 20 oil into the small oil hole which is provided in the top of each bearing housing and is closed by a screw plug.

(2) After every 5000 hours of operation or at intervals of one year, add approximately 0.05 cu. in. (3/8-in. cube) of ball bearing grease to each bearing through the oil hole mentioned above.

NOTE: Do not add more oil or grease than specified above, since the excess lubricant will tend to work out of the bearing housing onto the commutators and brushes where it will cause trouble if not wiped off. Too much grease in the bearing will have a tendency to churn and may cause the bearing to overheat. Always make certain that the lubricants used are clean and that no dirt, moisture or foreign matter enters the oil hole when adding the lubricant. Tighten screw plugs securely into the oil holes as soon as lubricant is added.

(3) After every 10,000 hours of operation or at least every two years, remove the armature from the dynamotor, thoroughly clean the bearings and bearing housings with carbon tetrachloride and repack each ball bearing level full of approved ball bearing grease. See procedure for disassembly and cleaning of bearings (paragraph [illegible] (4)).

c. Reel RL-30-B: The construction of this unit is such that it will require very little attention. The following lubrication routine is recommended to obtain the best operating results:

(1) After every 20 hours of flying service apply six drops of SAE 10 oil at the oil hole indicated on the hub nameplate.

(2) After every 1000 hours of flying time or every six months, whichever comes first, do as follows:

(a) Remove the three fillister head screws which hold the crank handle lever to the hub and remove the crank.

(b) Remove the small cotter pin and castle nut on the end of the reel shaft.

(c) Remove reel spool and hub from the shaft.

(d) Clean the accumulated dirt from reel shaft and the parts in the mounting base. Examine the exterior parts of the reel hub and clean off all dirt.

(e) Lubricate these points using SAE 10 oil:

Counter gear shaft bearing—1 drop.

Main shaft—several drops along the bearing surfaces.

Rear ball bearing on hub adjacent to ratchet teeth—5 drops.

Front thrust bearing around the edge of the retaining nut at the front end of the hub—5 drops.

Front ball bearing around the gap between the outside of the hub and the edge of the piece into which the three screws from the crank handle lever are threaded—5 drops.

(f) Reassemble the reel as follows: Place the reel spool and hub on the shaft. Give the spool a slight spin clockwise until the ratchet engages the pawls.

Replace the castle nut with the fingers, run it down until snug and then back it off until the hub runs free (at least 1/6 of a turn). Replace the cotter pin. Assemble the crank handle and tighten the three fillister head screws.

This completes the operation of servicing the reel.

d. Miscellaneous Lubrication

The following miscellaneous lubrication instructions should be followed in connection with the maintenance of Radio Transmitter BC-375-D. Places to oil and grease are listed. Do this after every 500 hours of service or at least after every 1000 hours. Do it oftener if dirt accumulation is excessive. Clean parts as required.

Oil SAE 20—Switch shafts in radio transmitter, transmitter tuning units, and antenna tuning unit. Vernier mechanisms in radio transmitter, transmitter tuning unit, and antenna tuning unit. Variable capacitor shafts in radio transmitter and transmitter tuning units.

Grease—Contacts of switches, and switch positioning devices in radio transmitter, transmitter tuning unit and antenna tuning unit.

NEVER lubricate the contact roller or the contact roller shaft of the rotating antenna inductor. These parts should run DRY and should always be kept spotlessly clean. Carbon tetrachloride should be used to clean these parts.

22. SERVICE NOTES

In the servicing and locating of faults in the radio transmitter and associated equipment, it is necessary to remove various shields and covers to make the circuits accessible. Great care must be taken in testing with shields removed, because a great many points of high voltage are thus exposed. Whenever such testing is necessary, the proper procedure is to remove all power from the equipment, make the necessary circuit changes or meter connections and then apply power, keeping clear of all meters which are connected in the "high" sides of circuits where there may exist an appreciable voltage to ground.

Always remember that when the dynamotor is running and the transmitting key is open, high voltage is present in the radio transmitter even though there is no plate ammeter reading.

In checking low voltage and filament circuits, the single conductor cord with the Plug PL-59 should be disconnected from the transmitter, thus removing the high-voltage supply. It will be noted from

observation of the schematic diagram (Fig. 1) that two tube filaments are connected in series. Thus, if one fails, two filaments will go out. The defective tube can be determined by use of a continuity meter.

The following information is supplied to aid in servicing the equipment:

a. Voltage Readings

(A high-resistance voltmeter should be used—at least 1000 ohms per volt.)

(1) Low-voltage input of 24 to 28 volts, depending on the power-supply voltage, should be obtained from terminal 45 of Socket SO-41 to ground.

(2) Speech-amplifier plate voltage of approximately 425 volts should be obtained at the plate connection of the speech-amplifier tube when the transmitter is on VOICE. It is recommended that a tube socket adapter be used which will allow not only readings of voltages but also all currents for the Tube VT-25.

(3) Modulator bias voltage of 72 to 75 should be obtained across capacitor 1160, the positive side being at ground potential. Selector switch should be on VOICE.

(4) Speech-amplifier bias voltage of 35 to 40 should be obtained across capacitor 1144, the positive side being at ground potential. Radio transmitter switch should be on VOICE.

(5) Plate voltage of 1000 to 1100 volts should be obtained between terminal 61 of Socket SO-39 and ground.

(6) Keying voltage of approximately 200 volts will be obtained across resistor 1115 when keying relay 1189 is open.

(7) Microphone-supply voltage of 4.5 to 5.3 volts d-c should be obtained across resistor 1145.

For this test, the microphone should be in the circuit.

b. Current Readings

(1) Speech-amplifier plate current should be from 19 to 21 milliamperes. Adjustment of its bias voltage to obtain this value is accomplished by potentiometer 1114 which is accessible in the tube compartment. The normal setting of this potentiometer will usually be between dial positions 6 and 7.5.

(2) Modulator plate current may be determined by observing the increase in total plate current reading when changing from CW to VOICE and impressing normal modulation. The modulator plate current should average 100 to 160 milliamperes for sustained tones. A greater or smaller value than this indicates that a readjustment of the input level should be made.

(3) Master-oscillator plate current can be determined on the total-plate-current meter by removing the p-a and speech-amplifier tubes and placing the transmitter on CW. The current indicated should be from 30 to 75 milliamperes, depending on the transmitter tuning unit in use.

(4) Power-amplifier plate current may be determined by subtracting from the total plate current on CW the currents drawn by the master oscillator and speech amplifier. Its value should be from 100 to 150 milliamperes at full load.

(5) Master-oscillator grid current can be determined by connecting a d-c milliammeter in series with resistor 1109. Correct value should be from 30 to 50 milliamperes.

(6) Power-amplifier grid current can be determined by inserting a d-c milliammeter in series with resistor 1112. Correct value is from 15 to 25 milliamperes.

Various other circuits may be checked by referring to the schematic diagram. Then by referring to the various unit connection diagrams, the location of the various circuit elements may be ascertained.

c. Neutralization of Power Amplifier

Neutralization of the power amplifier is not ordinarily necessary, since this is done when the units are tested at the manufacturer's plant. However, if the setting is disturbed for any reason, the following procedure may be used to restore the adjustment.

The radio transmitter should first be set up and tuned to see that all power supplies are correct and the transmitter is functioning properly. Then remove the power supply cords and the back of the radio transmitter. From Fig. 2 locate wire 43 (red) on filter capacitor 1163. Remove this wire with a soldering iron and tape clear of terminal on capacitor 1197A. This removes the power-amplifier d-c plate voltage and leaves the r-f circuits intact. Connect the vertical plates of a cathode-ray oscillograph to terminals LOAD A and GND on the radio transmitter. Place the ANT. IND. TUNING, M at dial zero and the ANT. CIRCUIT SWITCH, N on position 3. Tune the p.a. to resonance as shown by a maximum amplitude of r-f carrier on the oscillograph. Proceed by turning the neutralizing control, behind the tuning chart, for a minimum amplitude on the oscillograph, at the same time maintaining the p.a. in tune. When the best minimum is reached, with the p.a. in tune, the tuning unit is neutralized. In the lower frequency tuning units, the oscillograph pickup will be practically zero at neutralization, while on the higher frequencies, considerable amplitude will be noticed from stray ground currents. A check on the neutralization may be made by noticing the low reaction on the total plate meter, at neutralization, as the p.a. is tuned through resonance. The operator must remove all power plugs, while the transmitter back cover is removed and lead (43) is resoldered.

d. Dynamotor Unit PE-73-C

(1) BRUSHES: The brushes can be removed by unscrewing the slotted brush cap on each side of the bearing bracket. It is recommended that each

brush be suitably marked to indicate which brush holder it came from and its relative position in that brush holder in order that the brushes may later be replaced in their original positions. THIS IS IMPORTANT. Blow out dust and clean all foreign matter from each brush holder and brush and make certain that the brushes slide freely in their brush holders, dressing the brushes with fine sandpaper, or a file, if necessary. Any brush which has worn down to a length of less than $\frac{3}{8}$ in. (measured from contact surface to near end of spring) should be replaced with new one. In installing new brushes it may be necessary to "sand-in" the brush in order to make its contact surface fit the contour of the commutator. The brush must slide freely in its holder.

"Sanding-in" may be accomplished by using a strip of No. 00 sandpaper about 5 in. by 1 in. for L.V. brushes and 8 in. by $\frac{5}{8}$ in. for H.V. brushes. Wrap the strip of sandpaper around the commutator with the sand surface out. Insert the brushes in the brush holders and replace the brush caps so that the brushes are pressed tightly against the sandpaper. Holding the ends of the sandpaper so as to stretch it tightly against the commutator, rotate the armature back and forth until the full width of the brush face is making contact against the sandpaper as indicated by the sanding marks or scratches on the contact surface of the brush when it is withdrawn. Sand the sides of the brush, if necessary, for a free fit in the holder.

No sanding should be necessary to secure a good brush fit with the original brushes if they are replaced correctly. Never apply oil, grease or any other lubricant to the brush, commutator or brush holder. Under normal conditions of operation, it is estimated that the useful life of brushes is 2000 hours for low-voltage and 10,000 hours for high-voltage brushes.

(2) COMMUTATORS: Both commutators should be wiped with a clean, lintless cloth. Any scum appearing on the low-voltage commutator should be removed by moistening the cloth in carbon tetrachloride. The normal black or dark brown polished surface on the high-voltage commutator should not be removed. The type of brush material used in the low-voltage brushes of the dynamotor unit may, under certain conditions of installation, cause a discoloration of the low-voltage commutator. Under these circumstances the commutator will have a mottled appearance which is caused by the formation of a very thin oxide film on the surface of the commutator bars. This film is normal and is not injurious to the commutator or brushes. Do not try to remove the oxide film described above. A rough or pitted commutator should be smoothed with No. 00 or finer sandpaper. **Never use emery cloth or a file.** Under normal conditions of operation the low-voltage and high-voltage commutators should not require turning down before 2000 hours and 10,000 hours of service respectively. However, if the commutator bars have worn down flush with the mica, the armature should be removed from the dynamotor to turn down the commutator face and undercut the mica between bars.

(3) BEARINGS: If the armature does not spin freely when rotated by hand with the brushes removed the following may be the cause:

(*a*) Dirt or other foreign matter in a bearing.

(*b*) Defective ball bearing (cracked race, chipped or flattened ball).

(*c*) Grease in bearing has become hard and gummy due to oxidation during long periods without actual use.

In any case, the armature should be removed from the frame as described in paragraph 22*d* (4) and the bearings thoroughly cleaned. If, after cleaning, the outer race will not spin smoothly, it is probably due to a cracked race or chipped or flattened ball, and the defective bearing should be removed and replaced with a new one. Always use a bearing puller to remove a defective bearing and never hammer or pry the bearing off since this may bend the shaft and injure the commutator. A new bearing should be pressed on the shaft until the inner race of the bearing rests against the shoulder on the shaft. For this operation always use an arbor press and a metal cylinder or collar which bears only against the inner race of the bearing. Care must be taken that no force or stress is placed on the outer race of either bearing at any time since this will usually result in a damaged bearing.

(4) DISASSEMBLY: The following procedure is recommended for disassembling the dynamotor unit for cleaning and repacking the bearings:

(*a*) Remove the three "safety-wired" screws on each end of the dynamotor unit and take off the two end bells.

(*b*) Unscrew the slotted brush cap in each brush holder and remove all four brushes. Take special care to mark the position of the brushes in their brush holders such that they may later be replaced in their exact original positions.

(*c*) Unscrew the four slotted screws located around the rim of the low-voltage bearing bracket and pry the bracket loose from the frame. The low-voltage end of the dynamotor unit can be identified by the long, small diameter commutator and the large copper-graphite brushes.

(*d*) Detach the two field leads from the terminal clamps on the low-voltage brush holders by unscrewing the screw in each terminal clamp. It is not necessary or advisable to remove the terminal clamp from the brush holders.

(*e*) The bearing bracket can now be taken out of the way and the armature withdrawn from the

frame. Take care not to injure the armature windings or commutator by rubbing against the field poles. Do not lose any shim washers which may be in the bearing housings, or which may stick to the bearing. If any shims are present they must be reassembled in the same housing.

(*f*) End Play Adjustment: A spanner screw is provided on one bearing bracket for adjusting end play in the dynamotor. This is properly adjusted at the factory and ordinarily will not need to be changed unless the armature is replaced. Before making any adjustments with this screw, it is necessary that two setscrews on either side of the bearing be loosened.

The proper adjustment is made by operating the dynamotor unit until it is hot (about 30 min.), then screwing the spanner screw in until the bearings begin to growl, then back off about ⅛ turn (45 degrees). The setscrews should then be tightened to hold the spanner nut in position.

(*g*) In cleaning the ball bearings it is not necessary to remove them from the armature shaft. Simply immerse the bearing in a shallow pan of clean carbon tetrachloride and wash all of the grease from the bearing. The use of a small camel's-hair brush will greatly aid the thorough cleaning of the bearing. Change the cleaning solvent in the pan as soon as it becomes dirty. Always use clean solvent for the final rinsing of the bearings.

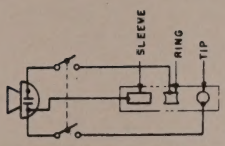
Do not allow the cleaning solvent to come in contact with the commutators or windings. In case the cleaning fluid is accidentally splashed on these parts, wipe it off immediately. Make certain the bearing is thoroughly clean and dry before repacking with new grease. If the bearing is not to be repacked with grease within a few minutes after cleaning, flush it with a clean, light mineral oil to protect the polished balls and races from rusting.

(*h*) In reassembling the dynamotor unit, follow in reverse order the procedure for disassembly. Make certain that the two field leads are securely attached to the proper terminal clamps on the low-voltage brush holders and that the "slack" or "loop" in these leads is "tucked" back of the field coils. Do not loosen or remove the brush holders from the bearing brackets. If a brush holder is loosened or removed for any reason, replace it securely in exactly its original position and check to make certain the contact surface of the brush fits the commutator perfectly. If necessary, sand-in the brush to secure a good fit against the commutator.

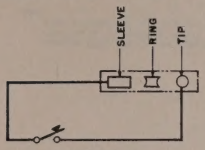
(5) TYPICAL PERFORMANCE: The dynamotor unit alone without the transmitter should operate approximately as follows on a load test:

Input		Output	
Volts	**Amperes**	**Volts**	**Milliamperes**
24.0	5–7.5	1140–1160	0
24.0	14–16.5	1070–1090	220
24.0	20–22.5	1025–1050	350

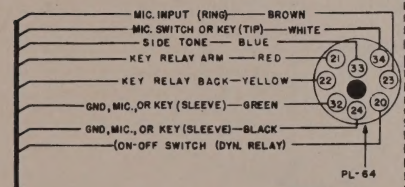
Note: The input current above includes that taken by the starting relay.



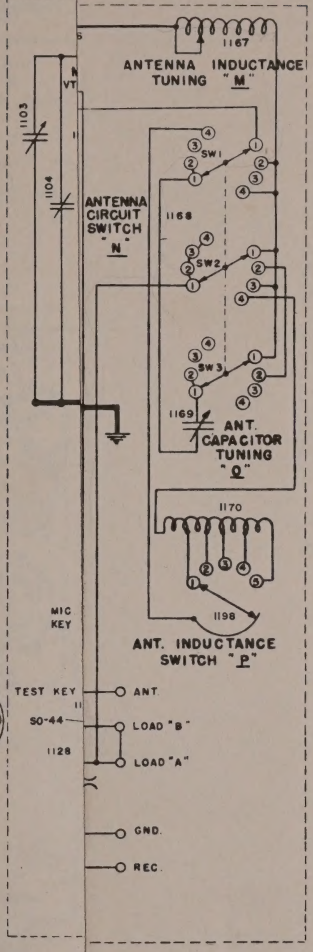
MICROPHONE CONNECTIONS

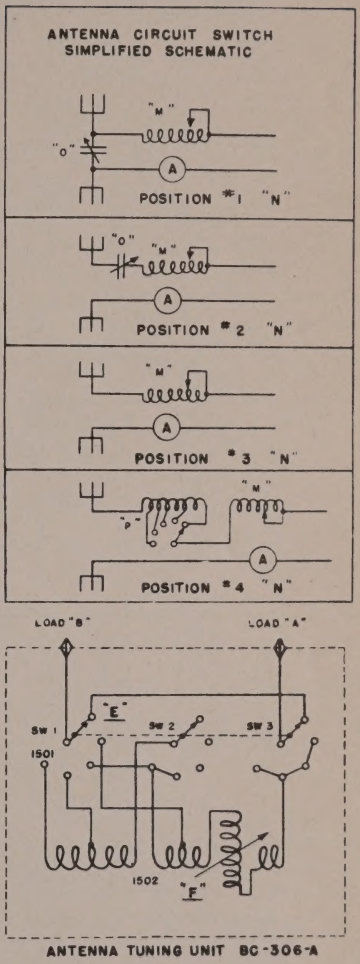


KEY CONNECTIONS



TO AIRPLANE JUNCTION BOX





ANTENNA TUNING UNIT BC-306-A

Fig. 1

frame. Take care not to injure the armature windings or commutator by rubbing against the field poles. Do not lose any shim washers which may be in the bearing housings, or which may stick to the bearing. If any shims are present they must be reassembled in the same housing.

(*f*) End Play Adjustment: A spanner screw is provided on one bearing bracket for adjusting end play in the dynamotor. This is properly adjusted at the factory and ordinarily will not need to be changed unless the armature is replaced. Before making any adjustments with this screw, it is necessary that two setscrews on either side of the bearing be loosened.

The proper adjustment is made by operating the dynamotor unit until it is hot (about 30 min.), then screwing the spanner screw in until the bearings begin to growl, then back off about ⅛ turn (45 degrees). The setscrews should then be tightened to hold the spanner nut in position.

(*g*) In cleaning the ball bearings it is not necessary to remove them from the armature shaft. Simply immerse the bearing in a shallow pan of clean carbon tetrachloride and wash all of the grease from the bearing. The use of a small camel's-hair brush will greatly aid the thorough cleaning of the bearing. Change the cleaning solvent in the pan as soon as it becomes dirty. Always use clean solvent for the final rinsing of the bearings.

Do not allow the cleaning solvent to come in contact with the commutators or windings. In case the cleaning fluid is accidentally splashed on these parts, wipe it off immediately. Make certain the bearing is thoroughly clean and dry before repacking with new grease. If the bearing is not to be repacked with grease within a few minutes after cleaning, flush it with a clean, light mineral oil to protect the polished balls and races from rusting.

(*h*) In reassembling the dynamotor unit, follow in reverse order the procedure for disassembly. Make certain that the two field leads are securely attached to the proper terminal clamps on the low-voltage brush holders and that the "slack" or "loop" in these leads is "tucked" back of the field coils. Do not loosen or remove the brush holders from the bearing brackets. If a brush holder is loosened or removed for any reason, replace it securely in exactly its original position and check to make certain the contact surface of the brush fits the commutator perfectly. If necessary, sand-in the brush to secure a good fit against the commutator.

(5) TYPICAL PERFORMANCE: The dynamotor unit alone without the transmitter should operate approximately as follows on a load test:

Input		Output	
Volts	**Amperes**	**Volts**	**Milliamperes**
24.0	5–7.5	1140–1160	0
24.0	14–16.5	1070–1090	220
24.0	20–22.5	1025–1050	350

Note: The input current above includes that taken by the starting relay.

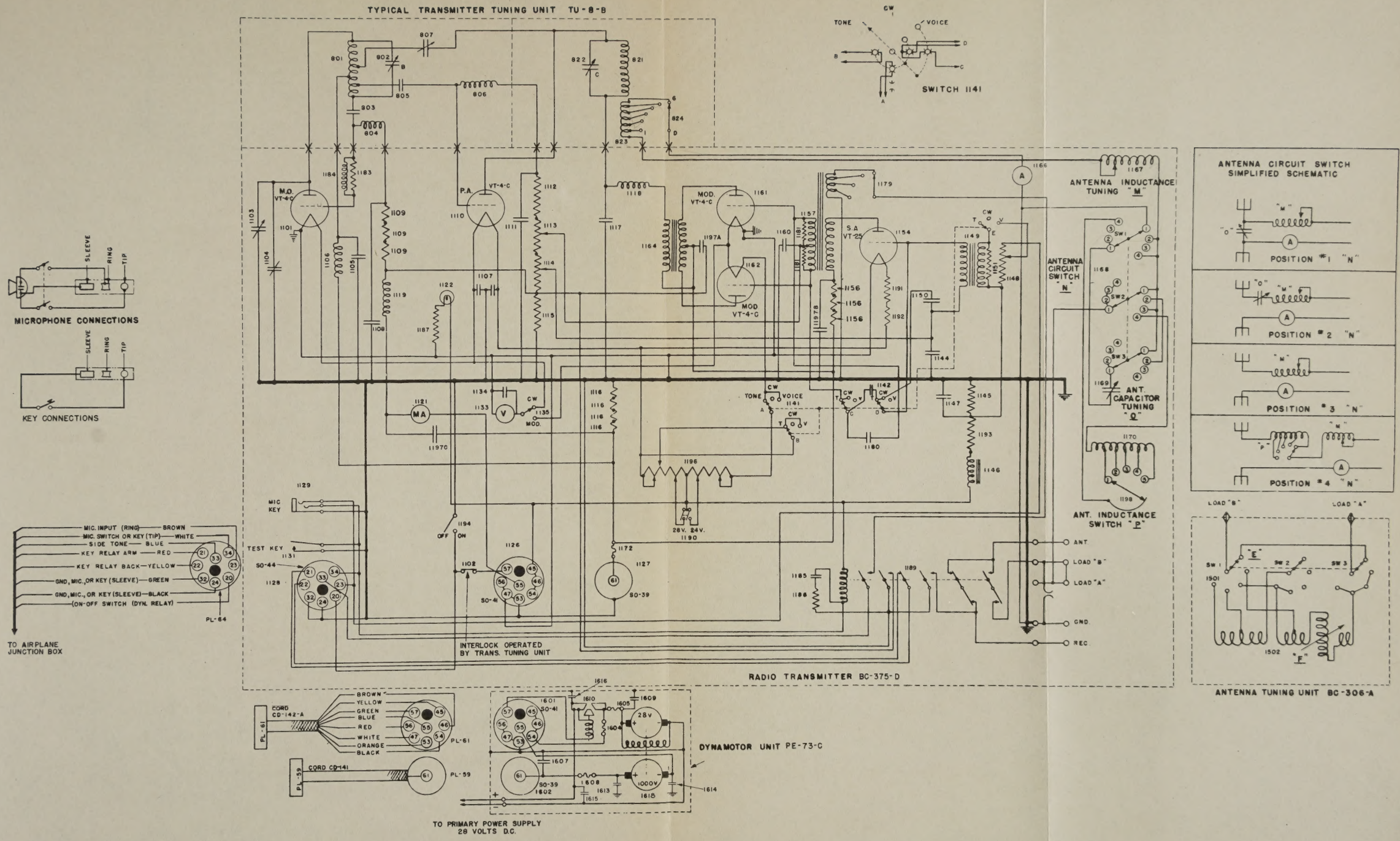
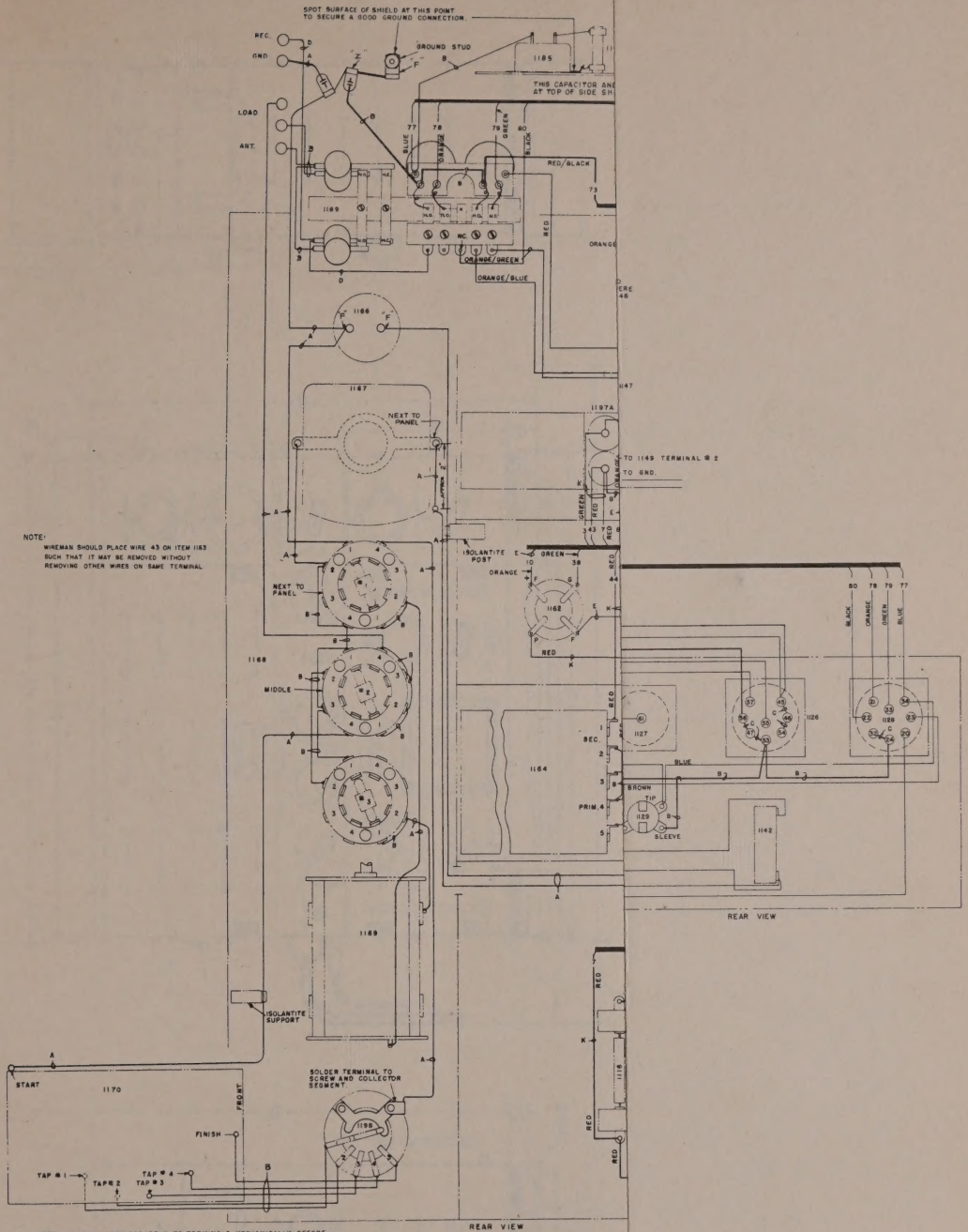


Fig. 1. Radio Transmitter BC-375-D, Schematic Diagram



NOTE:
WIREMAN SHOULD PLACE WIRE 43 ON ITEM 1183 SUCH THAT IT MAY BE REMOVED WITHOUT REMOVING OTHER WIRES ON SAME TERMINAL

NOTE:- FASTEN WIRES SECURELY TO TERMINALS MECHANICALLY BEFORE SOLDERING. USE ROSIN CORE SOLDER RESIDUE. APPLY ONE COAT OF W 1234 GLYPTAL OVER ALL SOLDERED JOINTS.

THE HEAVY LINES HIGHWAYS ARE MERELY GUIDE LINES TO ASSIST IN TRACING CONNECTIONS ON THE DIAGRAM AND DO NOT NECESSARILY INDICATE CABLES. CONDUCTORS SHOULD BE CABLED IN THE MOST CONVENIENT MANNER WHEREVER CABLING IS ADVANTAGEOUS.

HEAVY LINE FOR CONDUCTOR INDICATES GROUND CIRCUIT.
AT POINTS MARKED "A" (TUBE SOCKETS) USE COTTER PIN K-7870428.

AT POINTS MARKED "T" USE TERMINAL K-7872504.
AT POINTS MARKED "F" USE TERMINAL K-7870289.
AT POINTS MARKED "Z" USE TERMINAL K-7872369.

AT POINTS MARKED "W" USE $\frac{1}{16}$" X $\frac{3}{4}$" COTTER PIN.
AT POINTS MARKED "V" USE CONNECTOR K-7872680.
AT POINTS MARKED "Y" USE HOT TIN DIPPED WASHER V-417453

Fig. 2

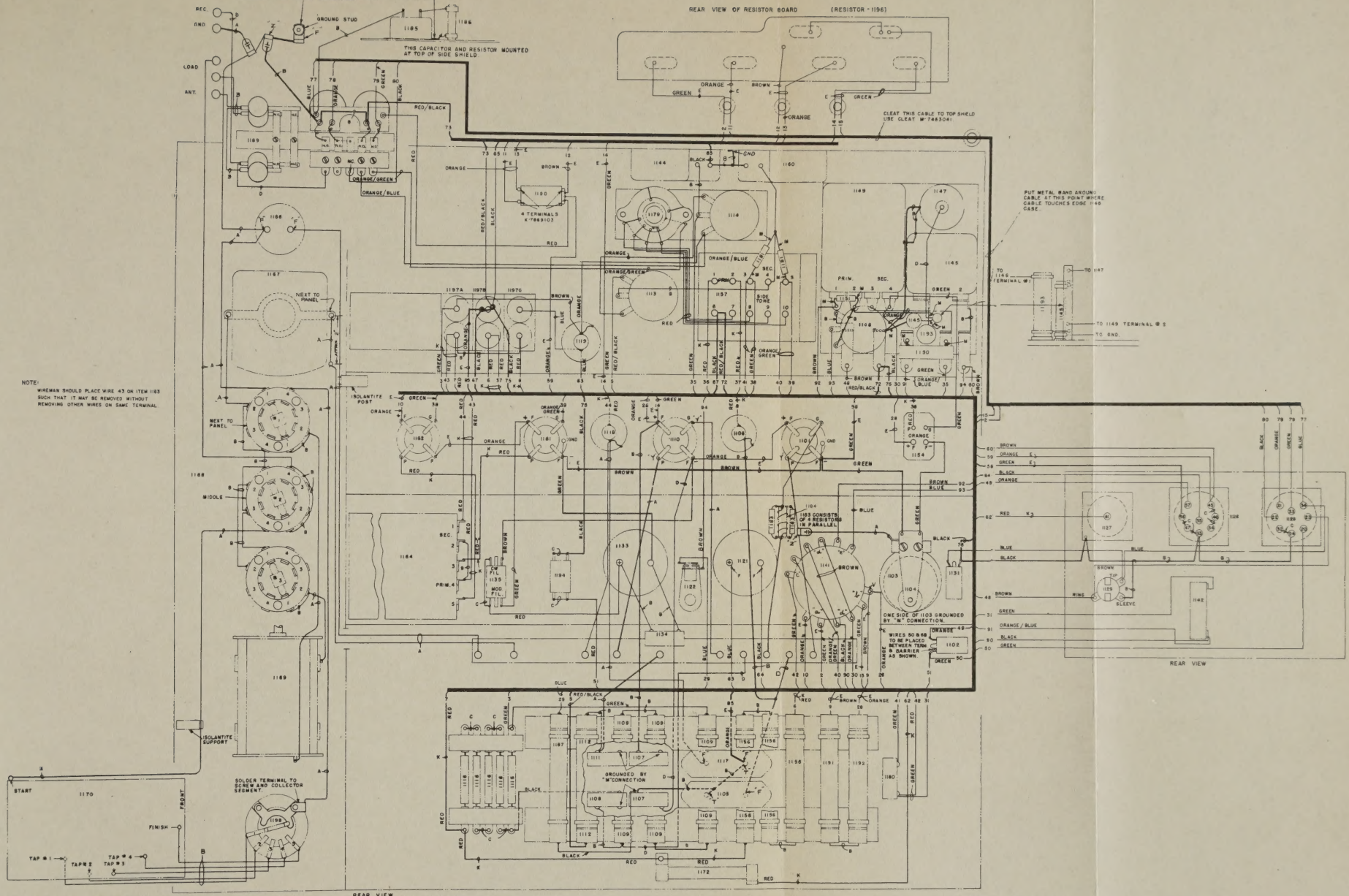
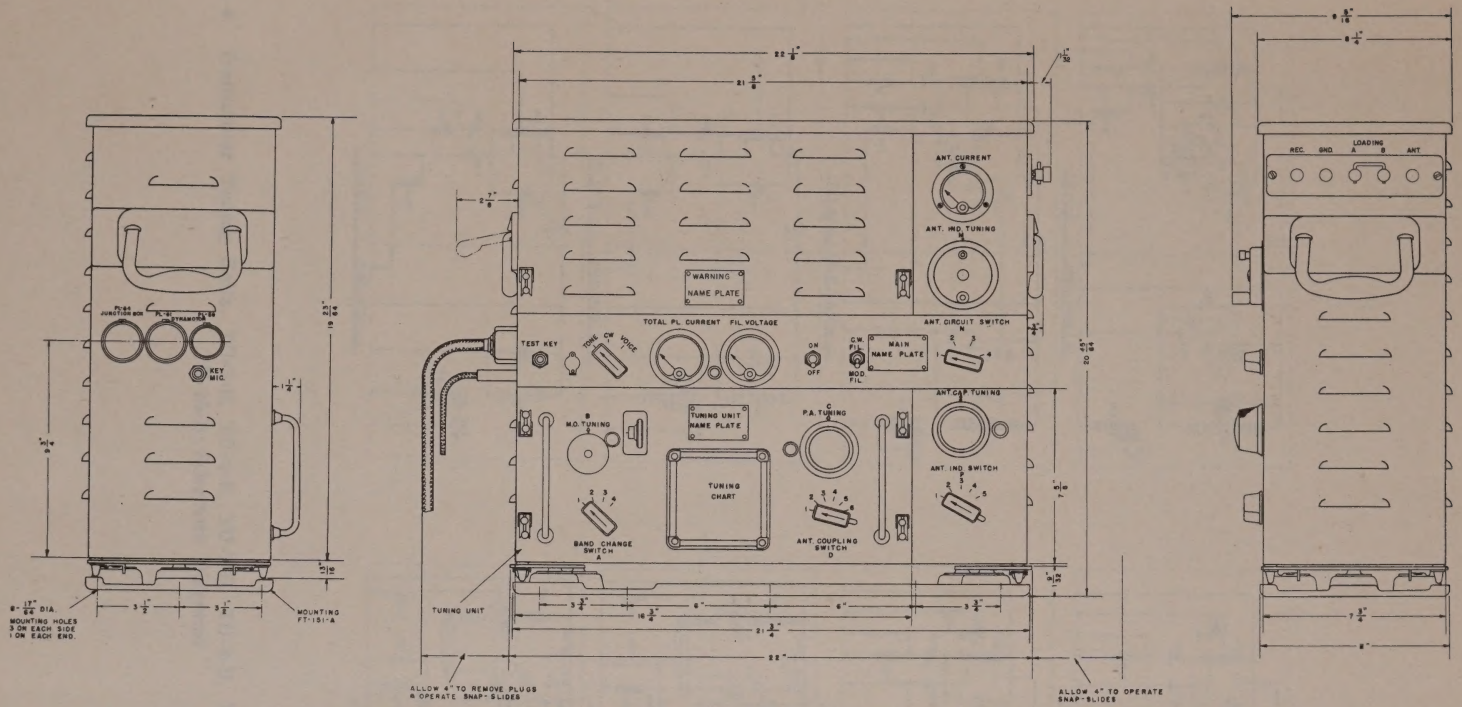

REAR VIEW OF RESISTOR BOARD (RESISTOR - 1196)
SPOT SURFACE OF SHIELD AT THIS POINT TO SECURE A GOOD GROUND CONNECTION
GROUND STUD
THIS CAPACITOR AND RESISTOR MOUNTED AT TOP OF SIDE SHIELD
REC.
GND.
LOAD
ANT.
CLEAT THIS CABLE TO TOP SHIELD USE CLEAT M-7483041
PUT METAL BAND AROUND CABLE AT THIS POINT WHERE CABLE TOUCHES EDGE OF CASE.
NEXT TO PANEL
MIDDLE
ISOLANTITE POST
ISOLANTITE SUPPORT
SOLDER TERMINAL TO SCREW AND COLLECTOR SEGMENT
START
FINISH
TAP #1
TAP #2
TAP #3
TAP #4
FRONT
REAR VIEW
4 TERMINALS K-7869103
SIDE TONE
PRIM.
SEC.
MOD FIL
1193 CONSISTS OF 4 RESISTORS IN PARALLEL
ONE SIDE OF 1103 GROUNDED BY "M" CONNECTION.
WIRES 50 & 68 TO BE PLACED BETWEEN TERM. & BARRIER AS SHOWN.
GROUNDED BY "M" CONNECTION
TO 1146 (TERMINAL #7)
TO 1147
TO 1149 TERMINAL # 2
TO GND.
TIP
RING
SLEEVE
REAR VIEW
NOTE:
WIREMAN SHOULD PLACE WIRE 43 ON ITEM 1183 SUCH THAT IT MAY BE REMOVED WITHOUT REMOVING OTHER WIRES ON SAME TERMINAL.
NOTE: FASTEN WIRES SECURELY TO TERMINALS MECHANICALLY BEFORE SOLDERING. USE ROSIN CORE SOLDER #2003C. APPLY ONE COAT OF # 1234 GLYPTAL OVER ALL SOLDERED JOINTS.
THE HEAVY LINES, HIGHWAYS, ARE MERELY GUIDE LINES TO ASSIST IN TRACING CONNECTIONS ON THE DIAGRAM AND DO NOT NECESSARILY INDICATE CABLES. CONDUCTORS SHOULD BE CABLED IN THE MOST CONVENIENT MANNER WHEREVER CABLING IS ADVANTAGEOUS.
HEAVY LINE FOR CONDUCTOR INDICATES GROUND CIRCUIT.
AT POINTS MARKED "X" (TUBE SOCKETS) USE COTTER PIN K-7870428.
AT POINTS MARKED "Y" USE TERMINAL K-7870504.
AT POINTS MARKED "Z" USE TERMINAL K-7870226.
AT POINTS MARKED "?" USE TERMINAL K-7872369.
AT POINTS MARKED "W" USE 1/16 X 3/8 COTTER PIN
AT POINTS MARKED "V" USE CONNECTOR K-7872680
AT POINTS MARKED "T" USE HOT TIN DIPPED WASHER V-617453

Fig. 2. Radio Transmitter BC-375-D, Connection Diagram



WEIGHTS IN POUNDS

Radio Transmitter BC-375-D, without Mounting, Transmitter Tuning Unit, and Tubes	49.0	Transmitter Tuning Unit TU-5-B ...	14.437
Mounting FT-151-A	3.75	Transmitter Tuning Unit TU-6-B ...	12.437
One Set of Tubes, Consisting of Four Tubes VT-4-C and One Tube VT-25	2.0	Transmitter Tuning Unit TU-7-B ...	11.687
		Transmitter Tuning Unit TU-8-B ...	11.437
		Transmitter Tuning Unit TU-9-B ...	11.437
		Transmitter Tuning Unit TU-10-B ...	11.437
		Transmitter Tuning Unit TU-22-B ...	12.250
		Transmitter Tuning Unit TU-26-B ...	12.750

Fig. 3. Radio Transmitter BC-375-D, Dimensions and Weights

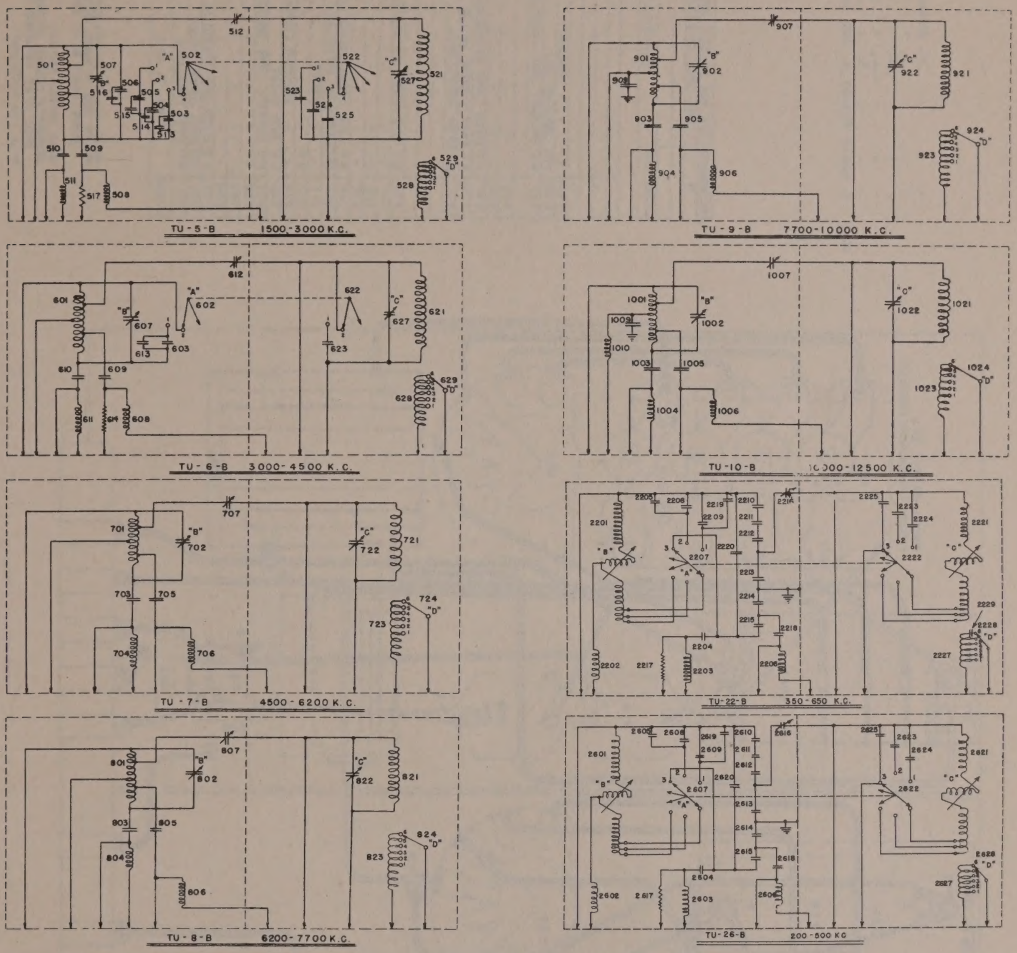
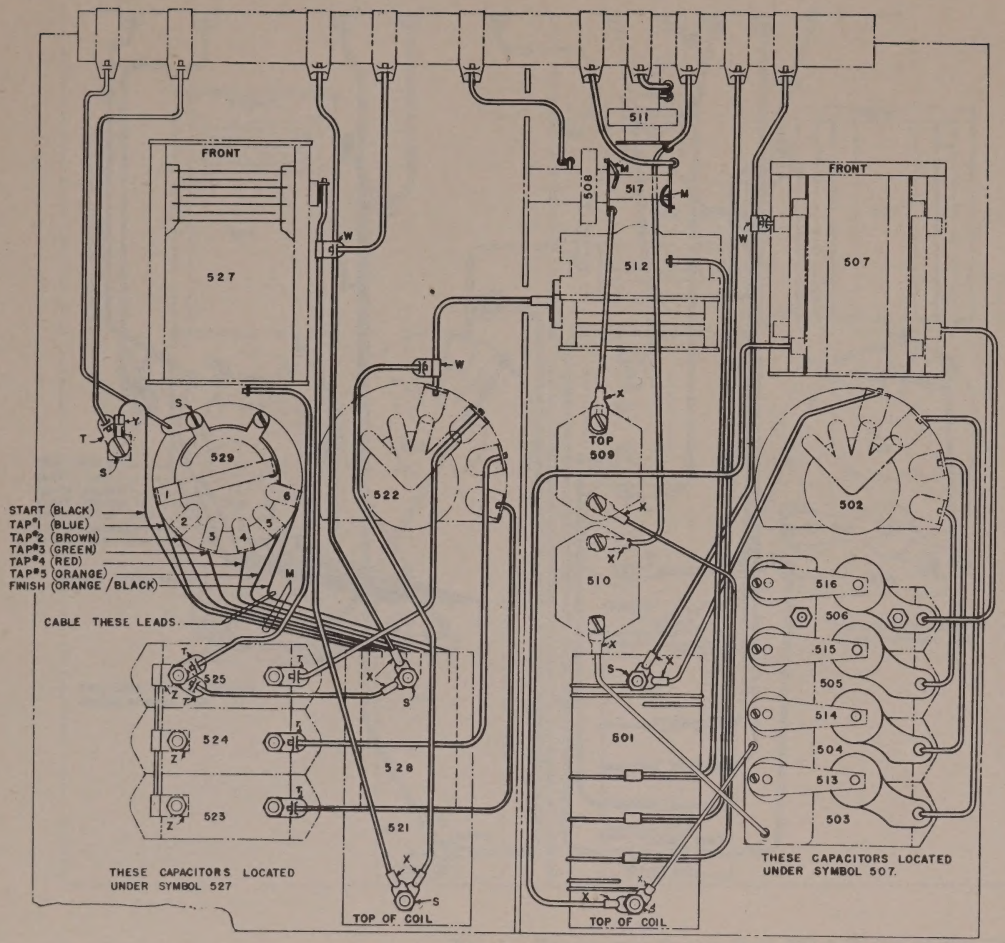


Fig. 4. Transmitter Tuning Units, TU-5-B, TU-6-B, TU-7-B, TU-8-B, TU-9-B, TU-10-B, TU-22-B, and TU-26-B; Schematic Diagrams



NOTE FOR SOLDERING :-
WIRE TO BE FASTENED MECHANICALLY TO TERMINALS BEFORE SOLDERING. USE ROSIN CORE SOLDER B20D3C.

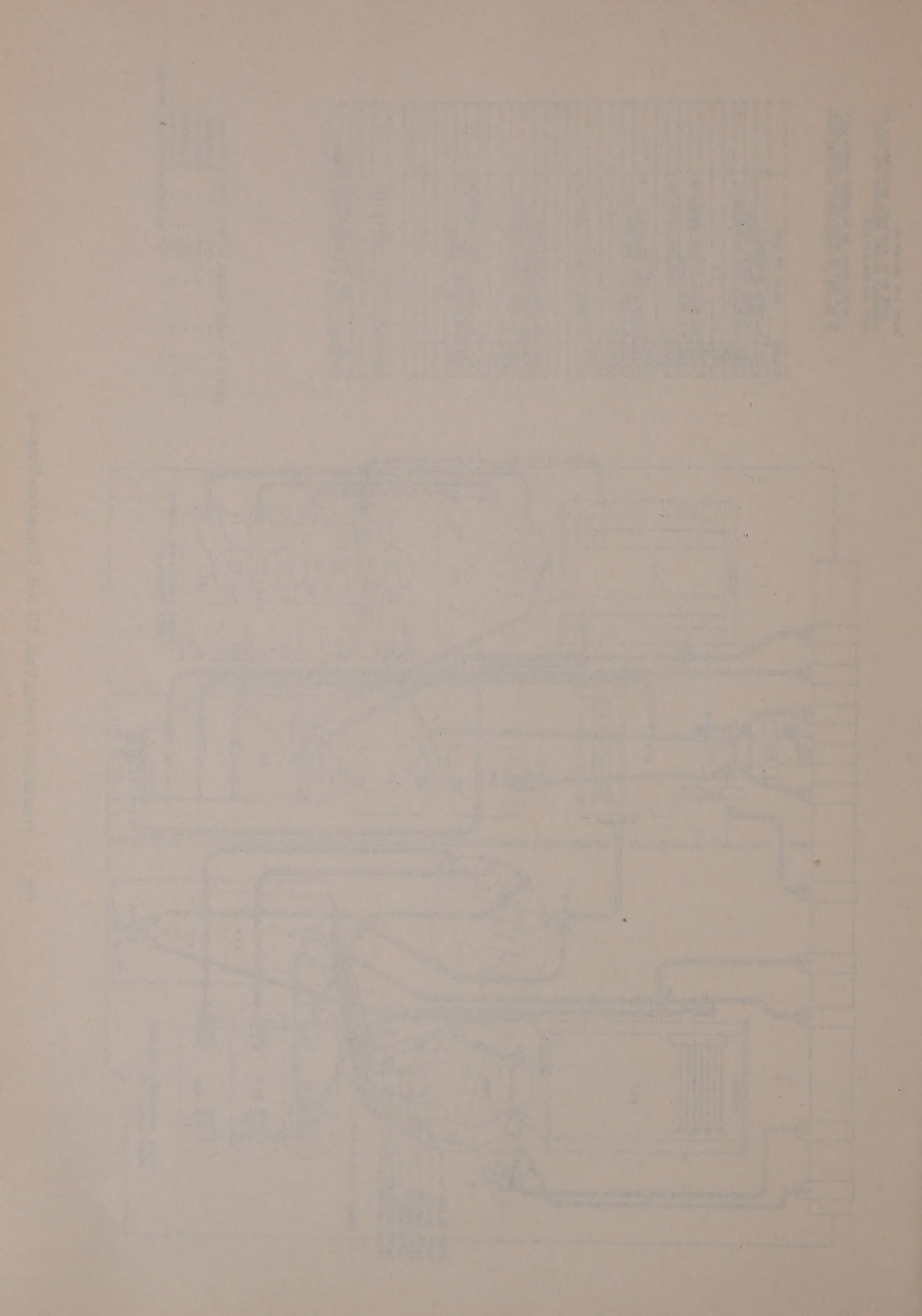
THERE SHALL BE NO SHARP POINTS LEFT AFTER UNIT IS WIRED EITHER FROM LUMPS OF SOLDER OR IRREGULARLY CUT WIRE ENDS.

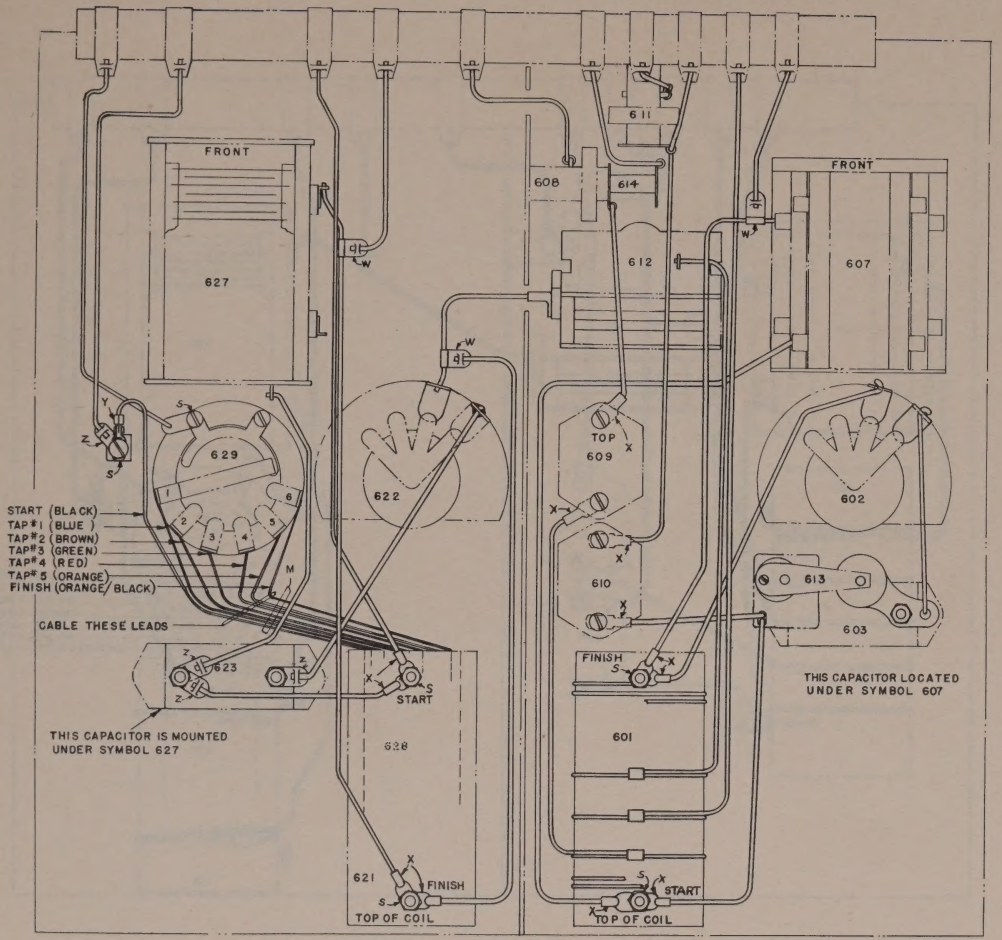
SYMBOL	NAME OF UNIT	
501	M.O. TANK INDUCTANCE	
502	M.O. BAND CHANGE SWITCH	
503	M.O. FIXED TANK CAPACITOR	
504	" " " "	
505	" " " "	
506	" " " "	
507	M.O. VARIABLE TANK CAPACITOR	
508	P.A. GRID CHOKE	
509	" " BLOCKING CAPACITOR	
510	M.O. " " "	
511	" " CHOKE	
512	NEUTRALIZING CAPACITOR	
513	M.O. TANK COMPENSATING CAP.	
514	" " " "	
515	" " " "	
516	" " " "	
517	M.O. GRID PARASITIC RESISTOR	
521	P.A. TANK INDUCTANCE	
522	P.A. BAND CHANGE SWITCH	
523	P.A. FIXED TANK CAPACITOR	
524	" " " "	
525	" " " "	
527	P.A. VARIABLE TANK CAPACITOR	
528	ANT. COUPLING COIL	
529	" " SWITCH	

CONNECTOR	DESCRIPTION
M	UNIT PIECE OF APPARATUS
NOT MARKED	.102" DIA. COPPER WIRE TINNED.

NOTE :- AT POINTS MARKED "X" USE TERM. V-1444451
" " " "Z" " " K-7872717
" " " "Y" " " V-2454945
" " " "W" " " K-7872368
" " " "T" " " K-7872305
" " " "S" SOLDER COMPLETE JOINT TOGETHER

Fig. 5. Transmitter Tuning Unit, TU-5-B, Connection Diagram





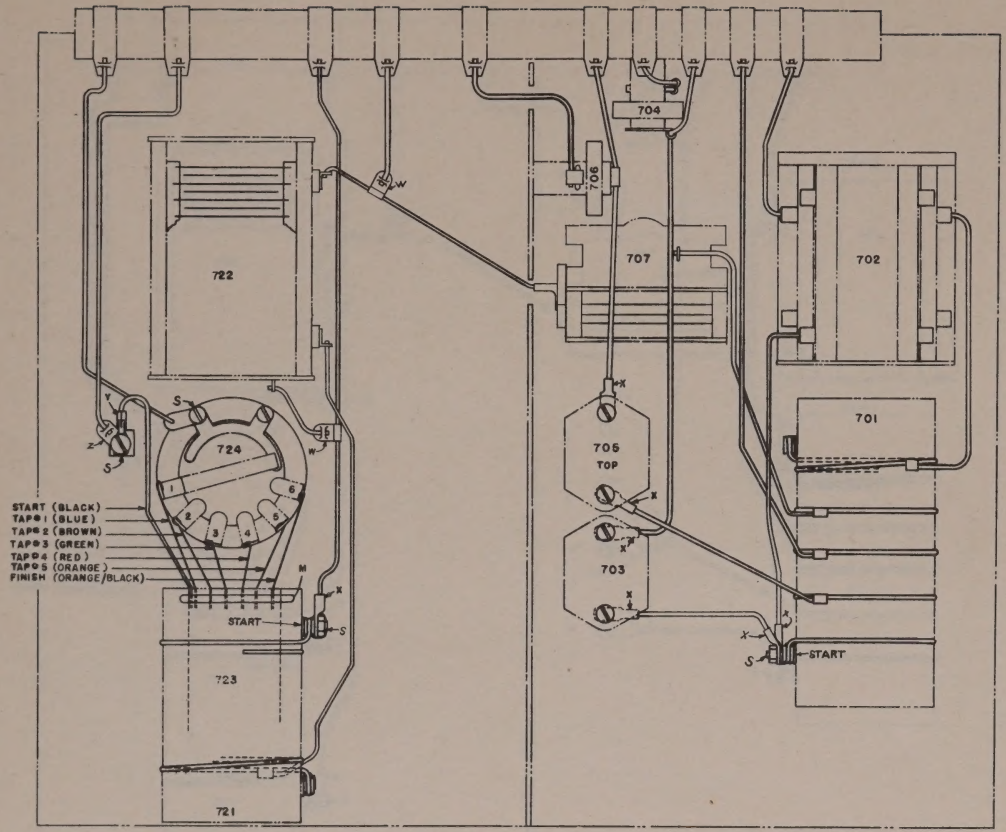
NOTE:
THERE SHALL BE NO SHARP POINTS LEFT AFTER UNIT IS WIRED EITHER FROM LUMPS OF SOLDER OR IRREGULARLY CUT WIRE ENDS.
WIRE TO BE FASTENED MECHANICALLY TO TERMINALS BEFORE SOLDERING.
USE ROSIN CORE SOLDER B20D3C

SYMBOL	NAME OF UNIT
601	M.O. TANK INDUCTANCE
602	M.O. BAND CHANGE SWITCH
603	M.O. FIXED TANK CAPACITOR
607	M.O. VARIABLE TANK CAPACITOR
608	P.A. GRID CHOKE
609	P.A. GRID BLOCKING CAPACITOR
610	M.O. GRID BLOCKING CAPACITOR
611	M.O. GRID CHOKE
612	NEUTRALIZING CAPACITOR
613	MO. COMPENSATING CAPACITOR
614	P.A. GRID PARASITIC RESISTOR
621	P.A. TANK INDUCTANCE
622	P.A. BAND CHANGE SWITCH
623	P.A. FIXED TANK CAPACITOR
627	P.A. VARIABLE TANK CAPACITOR
628	ANTENNA COUPLING COIL
629	ANTENNA COUPLING SWITCH

CONNECTION	SIZE OF CONNECTOR
M	UNIT PIECE OF APPARATUS
WIRE MARKED	.102 DIA. COPPER WIRE TINNED

NOTE: AT POINTS MARKED "X" USE TERM V-144451
" " " "Z" " " K-7872305
" " " "Y" " " V-2454945
" " " "W" " " K-7872368
" " " "S" SOLDER COMPLETE JOINT TOGETHER.

Fig. 6. Transmitter Tuning Unit, TU-6-B, Connection Diagram



NOTE:
AT POINTS MARKED "X" USE TERM. V-1444451
" " " "Z" " " K-7872305
" " " "Y" " " V-2454945
" " " "W" " " K-7872368
" " " "S" SOLDER COMPLETE JOINT TOGETHER.

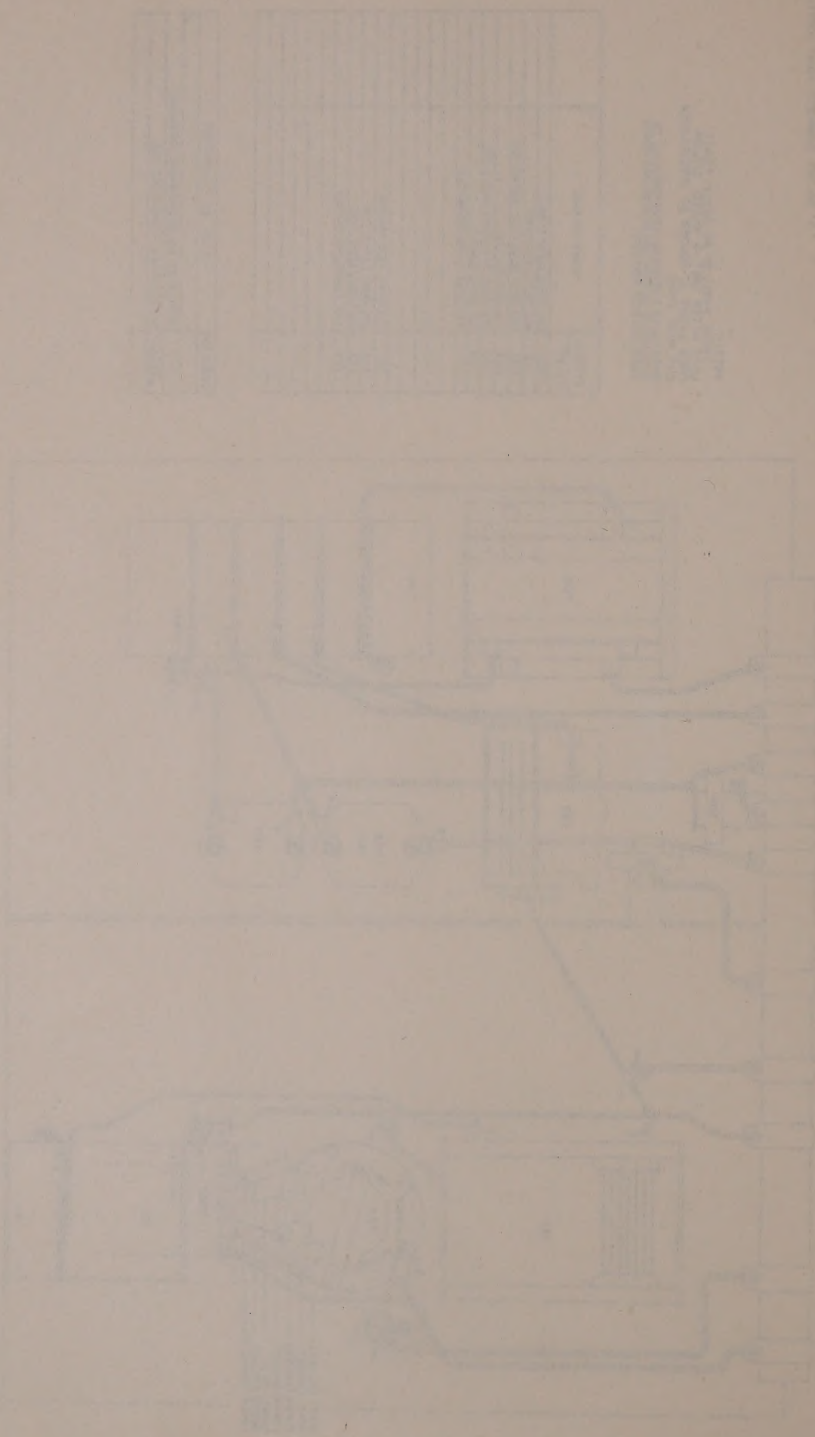
NOTE:-
THERE SHALL BE NO SHARP POINTS LEFT AFTER UNIT IS WIRED EITHER FROM LUMPS OF SOLDER OR IRREGULARLY CUT WIRE ENDS.

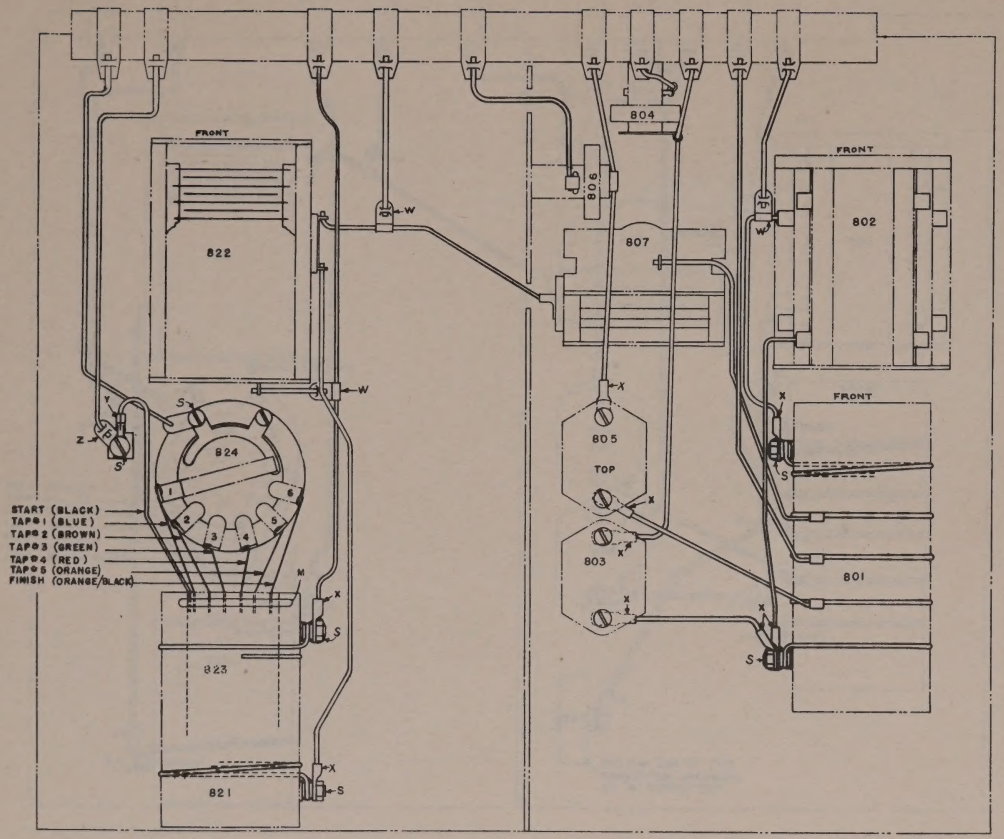
WIRE TO BE FASTENED MECHANICALLY TO TERMINALS BEFORE SOLDERING USE ROSIN CORE SOLDER B20D38

SYMBOL UNIT #7	NAME OF UNIT	
701	M.O. TANK INDUCTANCE	
702	M.O. TANK CAPACITOR	
703	M.O. GRID BLOCKING CAPACITOR	
704	M.O. GRID CHOKE	
705	P.A. GRID BLOCKING CAPACITOR	
706	P.A. GRID CHOKE	
707	NEUTRALIZING CAPACITOR	
721	P.A. TANK INDUCTANCE	
722	P.A. TANK CAPACITOR	
723	ANT. COUPLING COIL	
724	ANT. COUPLING SWITCH	

CONNECTION	SIZE OF CONNECTOR
M	SPECIFIED ON MECHANICAL DRAWING
NOT MARKED	COPPER WIRE TINNED .102 DIA.

Fig. 7. Transmitter Tuning Unit TU-7-B, Connection Diagram





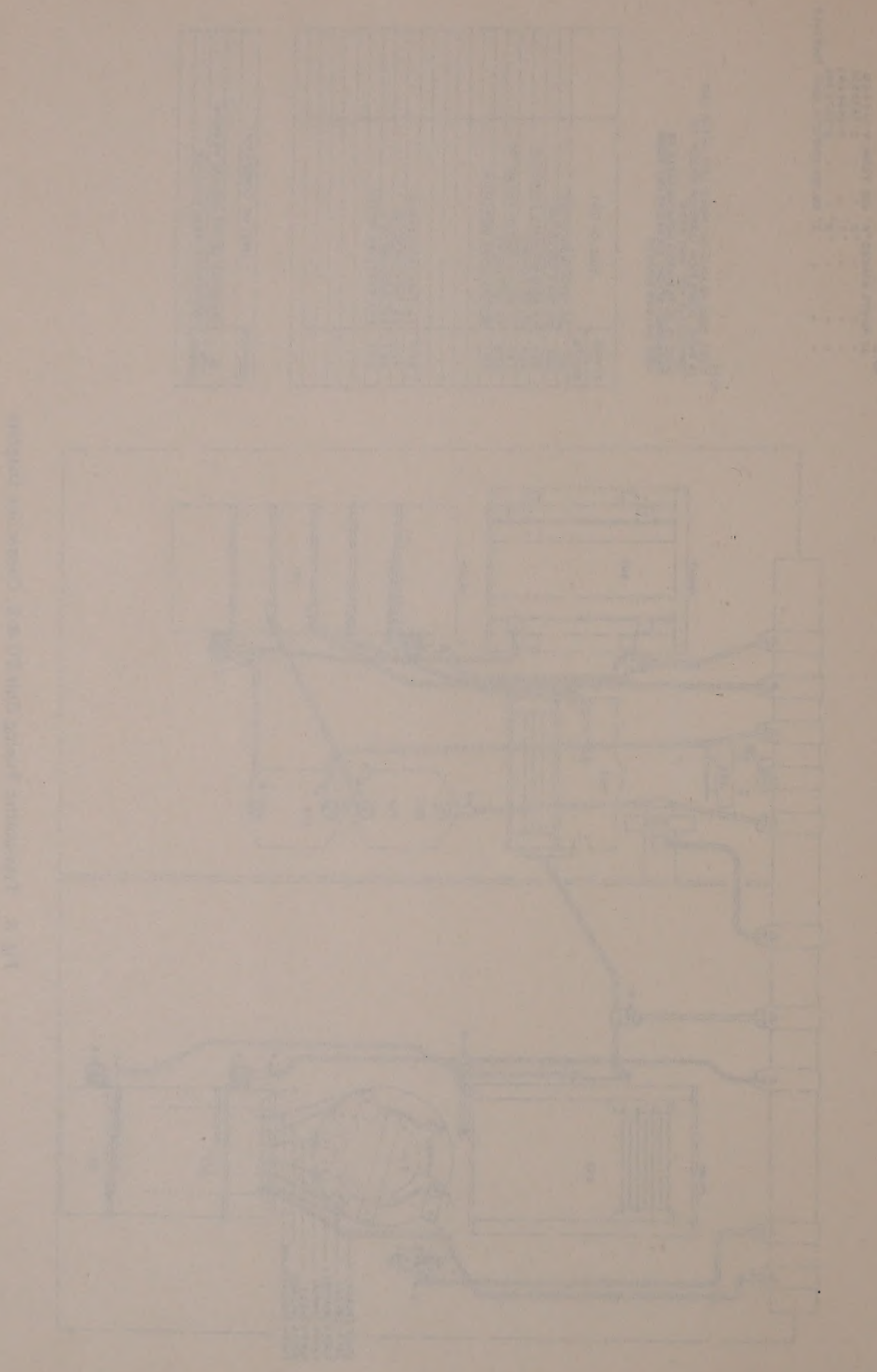
NOTE:
AT POINTS MARKED "X" USE TERM. V-144451
" " " "Z" " " K-7872305
" " " "Y" " " V-2454945
" " " "W" " " K-7872368
" " " "S" SOLDER COMPLETE JOINT TOGETHER.

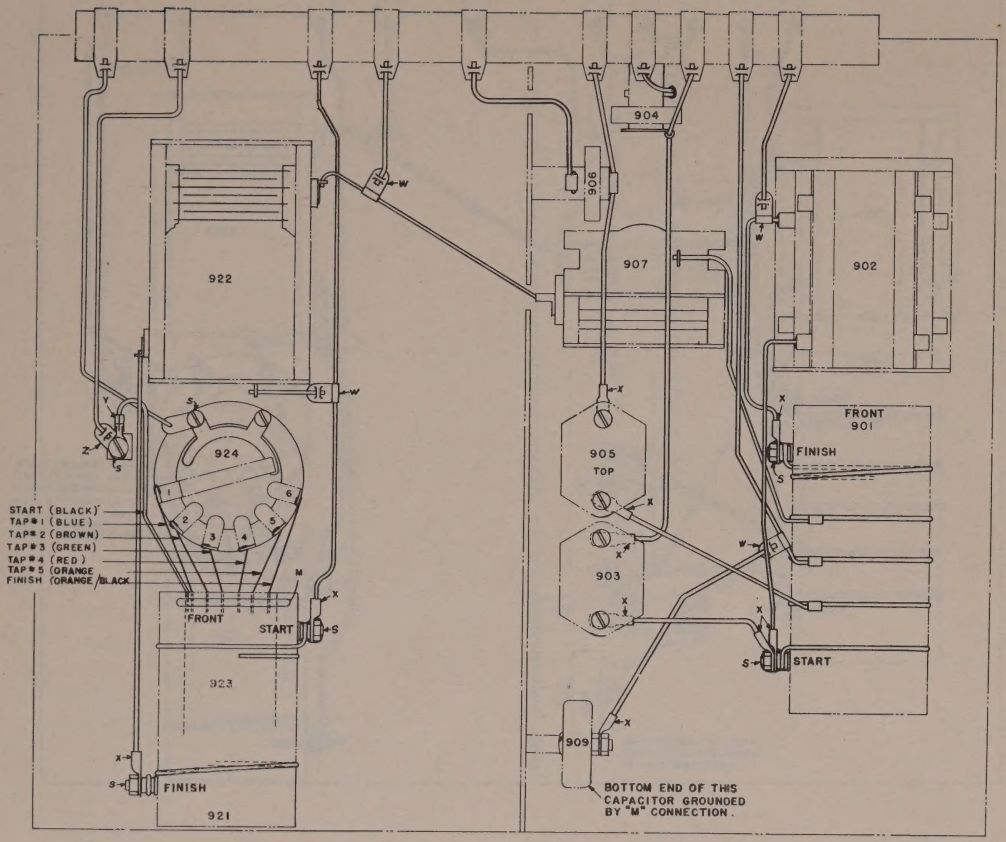
NOTE:
THERE SHALL BE NO SHARP POINTS LEFT AFTER UNIT IS WIRED EITHER FROM LUMPS OF SOLDER OR IRREGULARLY CUT WIRE ENDS.
WIRE TO BE FASTENED MECHANICALLY TO TERMINALS BEFORE SOLDERING. USE ROSIN CORE SOLDER 820D38

SYMBOL UNIT #8	NAME OF UNIT	
801	M.O. TANK INDUCTANCE	
802	M.O. TANK CAPACITOR	
803	M.O. GRID BLOCKING CAPACITOR	
804	M.O. GRID CHOKE	
805	P.A. GRID BLOCKING CAPACITOR	
806	P.A. GRID CHOKE	
807	NEUTRALIZING CAPACITOR	
821	P.A. TANK INDUCTANCE	
822	P.A. TANK CAPACITOR	
823	ANT. COUPLING COIL	
824	ANT. COUPLING SWITCH	

CONNECTION	SIZE OF CONNECTOR
M	SPECIFIED ON MECHANICAL DRAWING
NOT MARKED	COPPER WIRE TINNED .102 DIA.

Fig. 8. Transmitter Tuning Unit TU-8-B, Connection Diagram





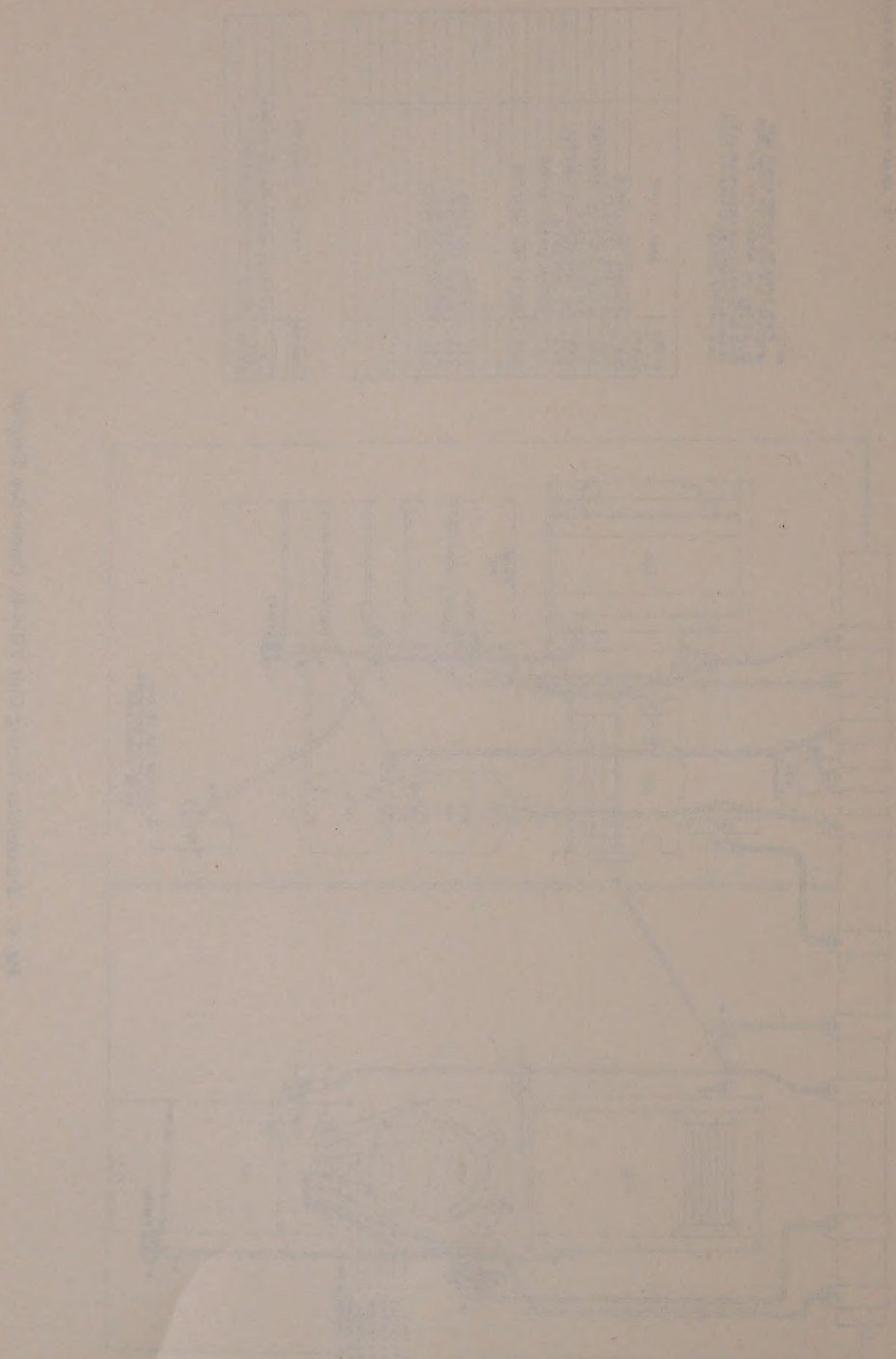
NOTE:
AT POINTS MARKED "X" USE TERM. V-144451
" " " "Z" " " K-7872305
" " " "Y" " " (V-2454945)
" " " "W" " " K-7872368
" " " "S" SOLDER COMPLETE JOINT TOGETHER.

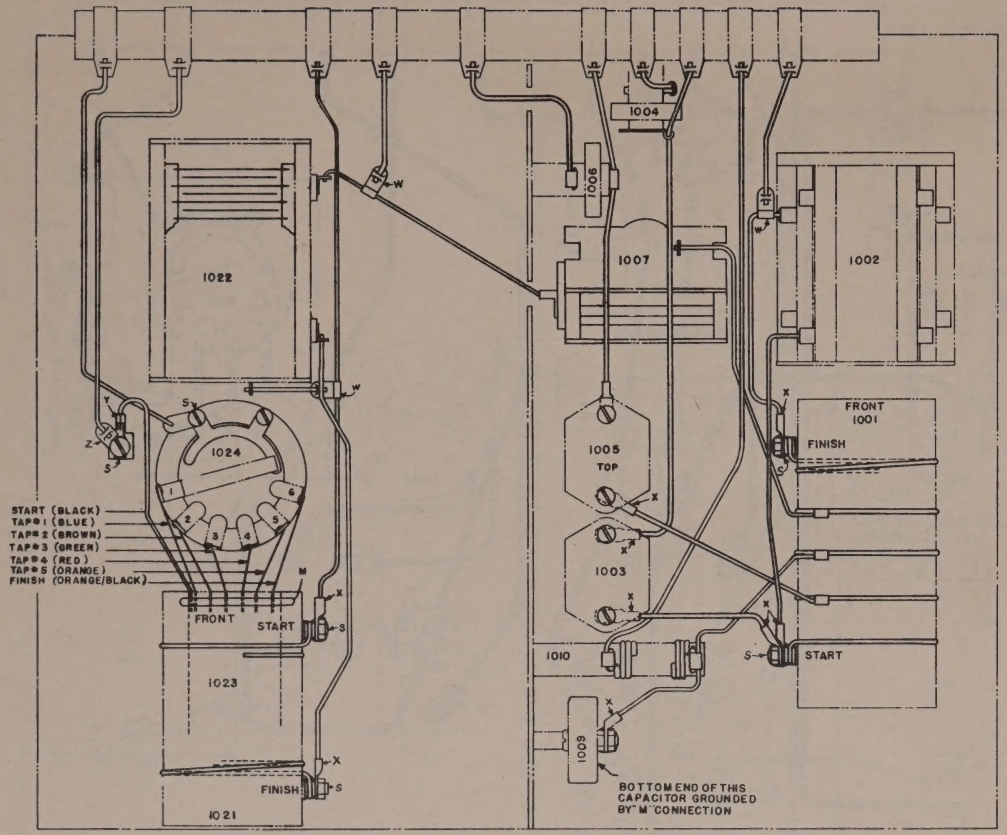
NOTE:-
THERE SHALL BE NO SHARP POINTS LEFT AFTER UNIT IS WIRED EITHER FROM LUMPS OF SOLDER OR IRREGULARLY CUT WIRE ENDS.
WIRE TO BE FASTENED MECHANICALLY TO TERMINALS BEFORE SOLDERING USE ROSIN CORE SOLDER 820D3B

SYMBOL UNIT #9	NAME OF UNIT	
901	M.O. TANK INDUCTANCE	
902	M.O. TANK CAPACITOR	
903	M.O. GRID BLOCKING CAPACITOR	
904	M.O. GRID CHOKE	
905	P.A. GRID BLOCKING CAPACITOR	
906	P.A. GRID CHOKE	
907	NEUTRALIZING CAPACITOR	
909	M.O. BY PASS CAPACITOR	
921	P.A. TANK INDUCTANCE	
922	P.A. TANK CAPACITOR	
923	ANT. COUPLING COIL	
924	ANT. COUPLING SWITCH	

CONNECTION	SIZE OF CONNECTOR
M	SPECIFIED ON MECHANICAL DRAWING
NOT MARKED	COPPER WIRE TINNED .102 DIA.

Fig. 9. Transmitter Tuning Unit TU-9-B, Connection Diagram





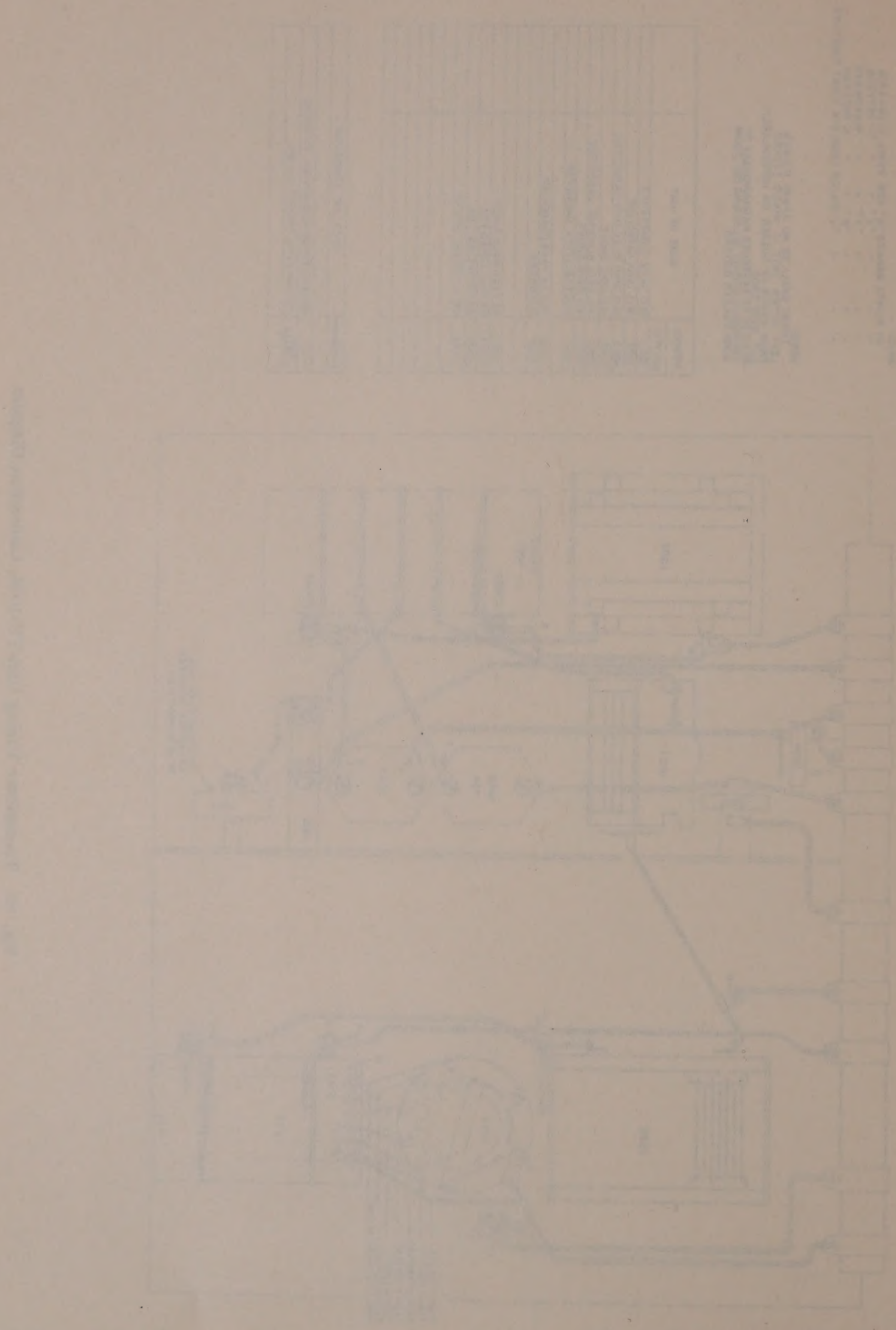
NOTE:
AT POINTS MARKED "X" USE TERM. V-144448
" " " "Z" " " K-7872305
" " " "Y" " " V-2454945
" " " "W" " " K-7872368
" " " "S" SOLDER COMPLETE JOINT TOGETHER.

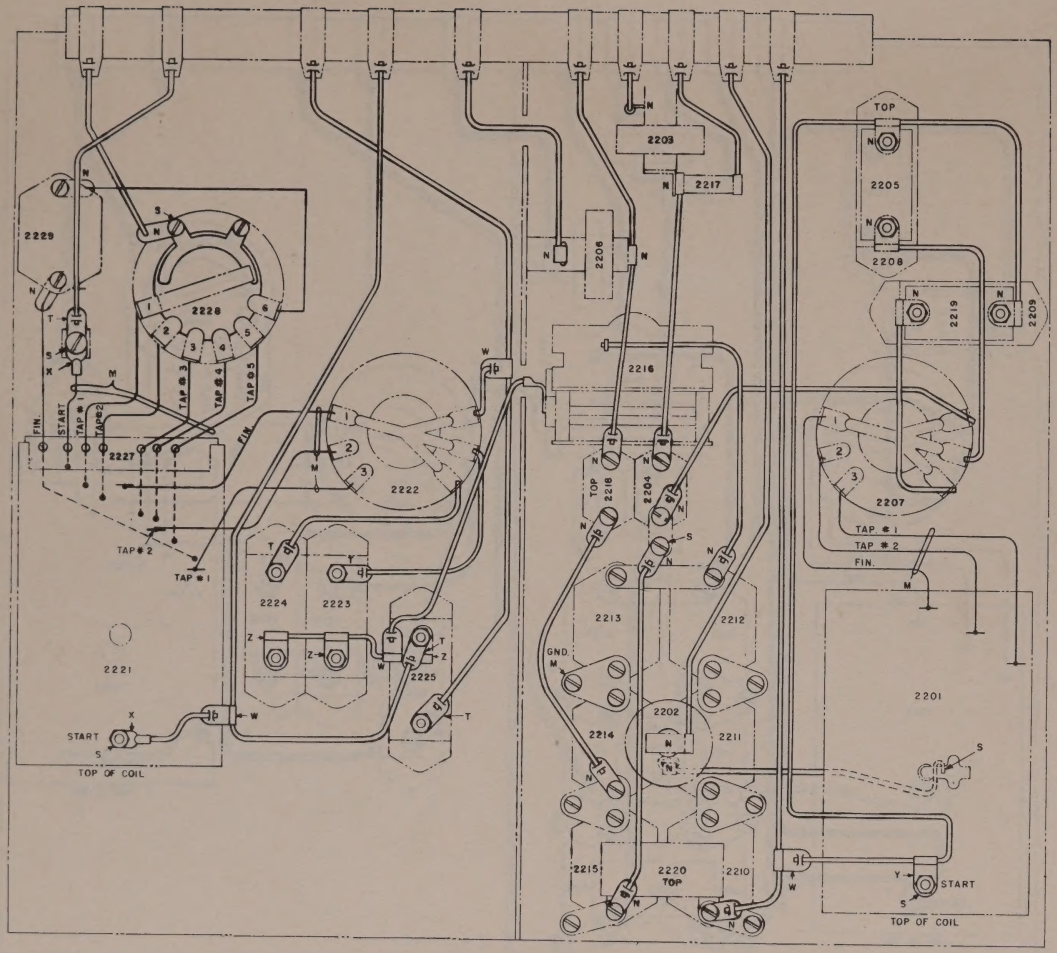
NOTE:-
THERE SHALL BE NO SHARP POINTS LEFT AFTER UNIT IS WIRED EITHER FROM LUMPS OF SOLDER OR IRREGULARLY CUT WIRE ENDS.
WIRE TO BE FASTENED MECHANICALLY TO TERMINALS BEFORE SOLDERING USE ROSIN CORE SOLDER B20D38

SYMBOL UNIT #10	NAME OF UNIT	
1001	M.O. TANK INDUCTANCE	
1002	M.O. TANK CAPACITOR	
1003	M.O. GRID BLOCKING CAPACITOR	
1004	M.O. GRID CHOKE	
1005	P.A. GRID BLOCKING CAPACITOR	
1006	P.A. GRID CHOKE	
1007	NEUTRALIZING CAPACITOR	
1009	M.O. BY PASS CONDENSER	
1010	M.O. CHOKE	
1021	P.A. TANK INDUCTANCE	
1022	P.A. TANK CAPACITOR	
1023	ANT. COUPLING COIL	
1024	ANT. COUPLING SWITCH	

CONNECTION	SIZE OF CONNECTOR
M	SPECIFIED ON MECHANICAL DRAWING
NOT MARKED	COPPER WIRE TINNED .102 DIA.

Fig. 10. Transmitter Tuning Unit TU-10-B, Connection Diagram





NOTE FOR SOLDERING:-
WIRE TO BE FASTENED MECHANICALLY TO TERMINALS BEFORE SOLDERING. USE ROSIN CORE SOLDER B20D3C.

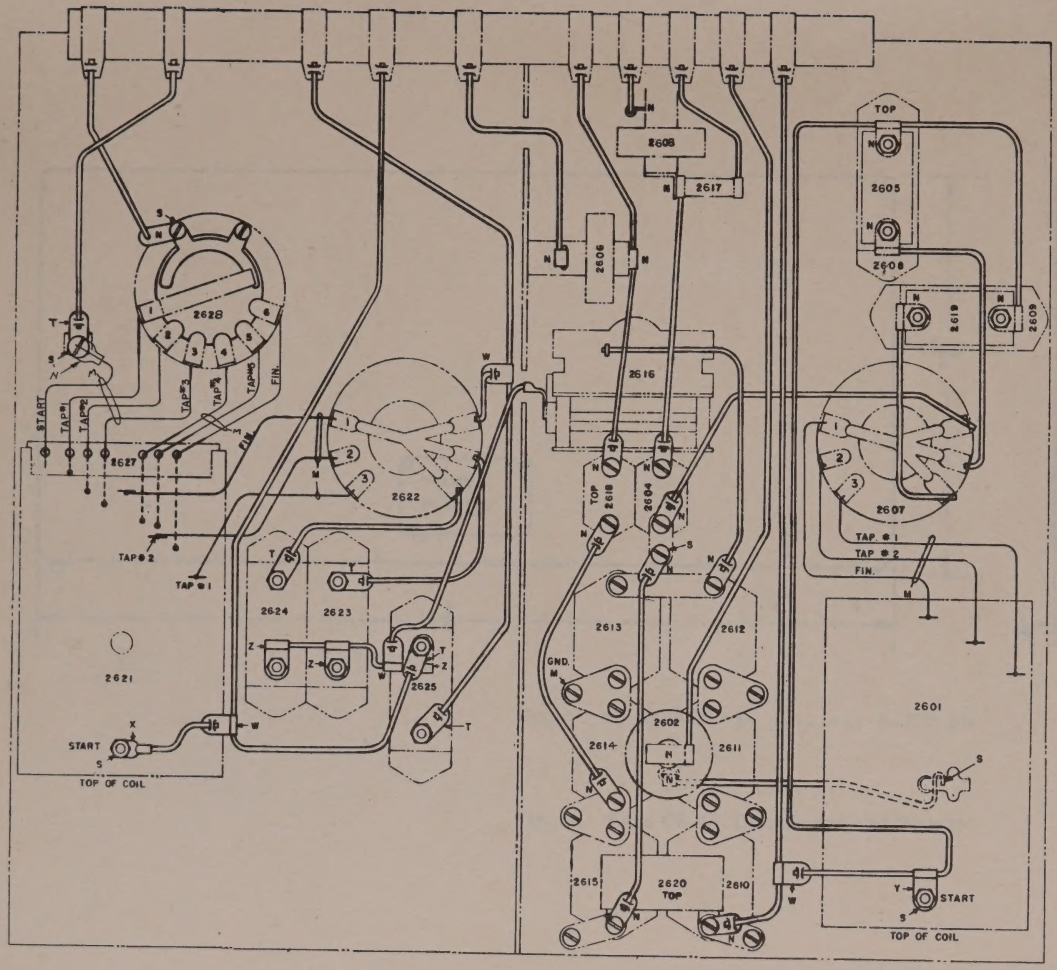
THERE SHALL BE NO SHARP POINTS LEFT AFTER UNIT IS WIRED EITHER FROM LUMPS OF SOLDER OR IRREGULARLY CUT WIRE ENDS.

SYMBOL	NAME OF PART	
2201	M.O. TANK INDUCTANCE	
2202	M.O. PLATE CHOKE	
2203	M.O. GRID CHOKE	
2204	M.O. GRID BLOCKING CAPACITOR	
2205	M.O. TANK COMPENSATING CAP.	
2206	P.A. GRID CHOKE	
2207	M.O. BAND CHANGE SWITCH	
2208	M.O. FIXED TANK CAPACITOR	
2209	M.O. FIXED TANK CAPACITOR	
2210	M.O. CHAIN CAPACITOR	
2211	M.O. CHAIN CAPACITOR	
2212	M.O. CHAIN CAPACITOR	
2213	M.O. CHAIN CAPACITOR	
2214	M.O. CHAIN CAPACITOR	
2215	M.O. CHAIN CAPACITOR	
2216	NEUTRALIZING CAPACITOR	
2217	M.O. GRID PARASITIC RESISTOR	
2218	P.A. GRID BLOCKING CAPACITOR	
2219	M.O. TANK COMPENSATING CAP.	
2220	M.O. TANK COMPENSATING CAP.	
2221	P.A. TANK INDUCTANCE	
2222	P.A. BAND CHANGE SWITCH	
2223	P.A. FIXED TANK CAPACITOR	
2224	P.A. FIXED TANK CAPACITOR	
2225	P.A. FIXED TANK CAPACITOR	
2227	ANT. COUPLING COIL	
2228	ANT. COUPLING SWITCH	
2229	ANT. COUPLING CAPACITOR	

CONNECTOR	DESCRIPTION
M	UNIT PIECE OF APPARATUS
NOT MARKED	.102" DIA. COPPER WIRE TINNED

NOTE:- AT POINTS MARKED "S" SOLDER COMPLETE JOINT TOGETHER.
AT POINTS MARKED "T" USE TERM. K-7872305.
AT POINTS MARKED "W" USE TERM. K-7872368.
AT POINTS MARKED "X" USE TERM. V-1444451.
AT POINTS MARKED "Z" USE TERM. K-7870226.
AT POINTS MARKED "N" TERMINALS CALLED FOR ON MECHANICAL DRAWING.
AT POINTS MARKED "Y" USE TERM. V-1451309.

Fig. 11. Transmitter Tuning Unit TU-22-B, Connection Diagram



NOTE FOR SOLDERING:-
WIRE TO BE FASTENED MECHANICALLY TO TERMINALS BEFORE SOLDERING. USE ROSIN CORE SOLDER B2003C.

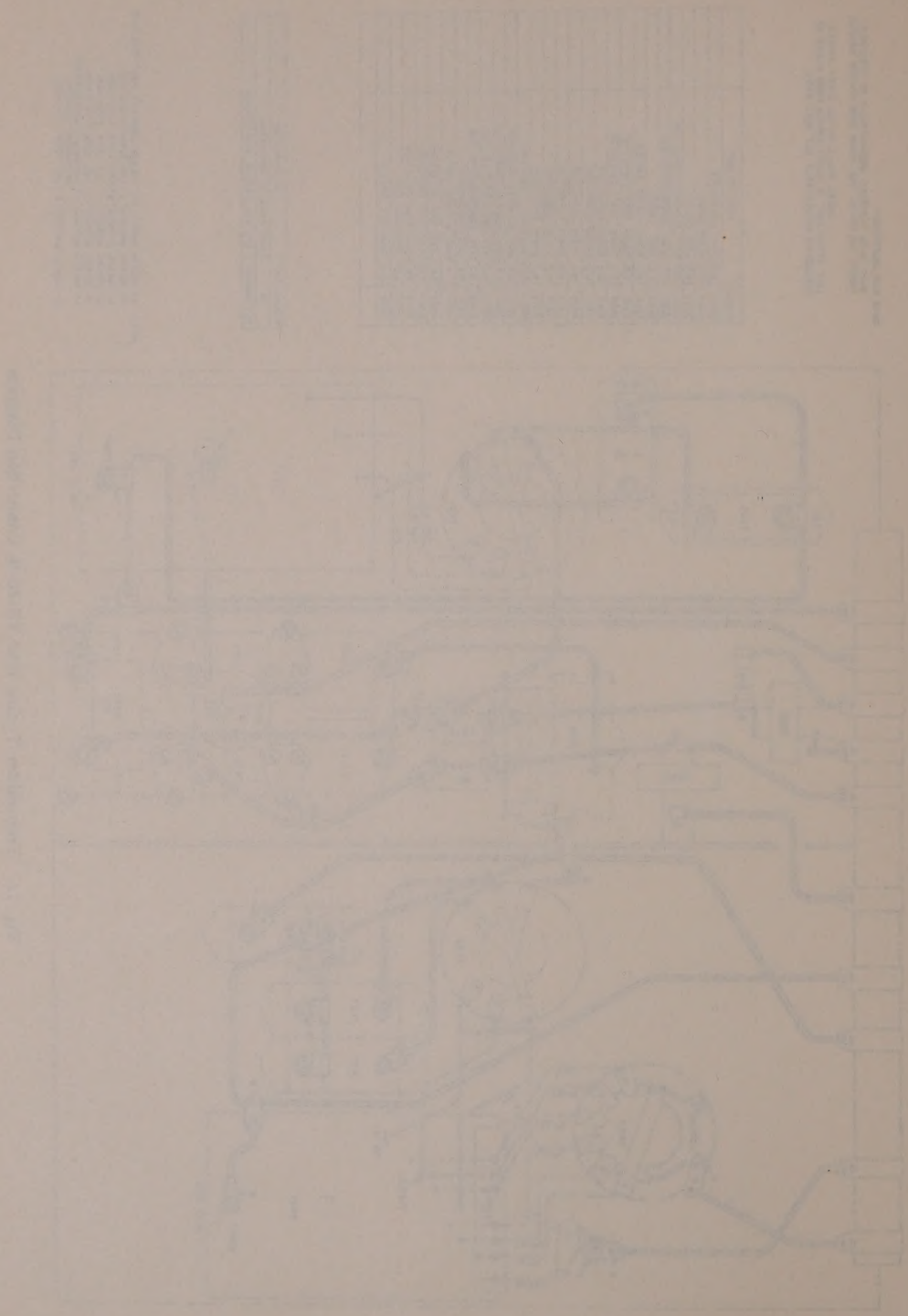
THERE SHALL BE NO SHARP POINTS LEFT AFTER UNIT IS WIRED EITHER FROM LUMPS OF SOLDER OR IRREGULARLY CUT WIRE ENDS.

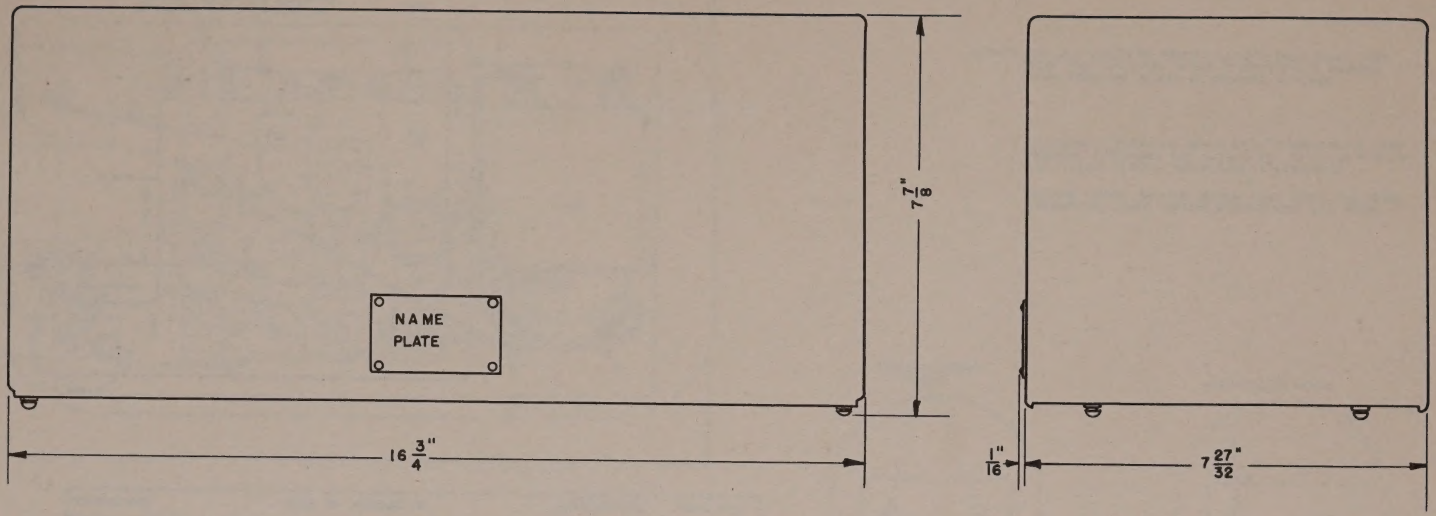
SYMBOL	NAME OF PART	
2601	M.O. TANK INDUCTANCE	
2602	M.O. PLATE CHOKE	
2603	M.O. GRID CHOKE	
2604	M.O. GRID BLOCKING CAPACITOR	
2605	M.O. TANK COMPENSATING CAP.	
2606	P.A. GRID CHOKE	
2607	M.O. BAND CHANGE SWITCH	
2608	M.O. FIXED TANK CAPACITOR	
2609	M.O. FIXED TANK CAPACITOR	
2610	M.O. CHAIN CAPACITOR	
2611	M.O. CHAIN CAPACITOR	
2612	M.O. CHAIN CAPACITOR	
2613	M.O. CHAIN CAPACITOR	
2614	M.O. CHAIN CAPACITOR	
2615	M.O. CHAIN CAPACITOR	
2616	NEUTRALIZING CAPACITOR	
2617	M.O. GRID PARASITIC RESISTOR	
2618	P.A. GRID BLOCKING CAPACITOR	
2619	M.O. TANK COMPENSATING CAP.	
2620	M.O. TANK COMPENSATING CAP.	
2621	P.A. TANK INDUCTANCE	
2622	P.A. BAND CHANGE SWITCH	
2623	P.A. FIXED TANK CAPACITOR	
2624	P.A. FIXED TANK CAPACITOR	
2625	P.A. FIXED TANK CAPACITOR	
2627	ANT. COUPLING COIL	
2628	ANT. COUPLING SWITCH	

CONNECTOR	DESCRIPTION
M	UNIT PIECE OF APPARATUS
NOT MARKED	.102" DIA. COPPER WIRE TINNED

NOTE:- AT POINTS MARKED "S" SOLDER COMPLETE JOINT TOGETHER.
AT POINTS MARKED "T" USE TERM. K-7872305.
AT POINTS MARKED "W" USE TERM. K-7872368.
AT POINTS MARKED "X" USE TERM. V-1444451.
AT POINTS MARKED "Z" USE TERM. K-7870226.
AT POINTS MARKED "N" TERMINALS CALLED FOR ON MECHANICAL DRAWING.
AT POINTS MARKED "Y" USE TERM. V-1451309.

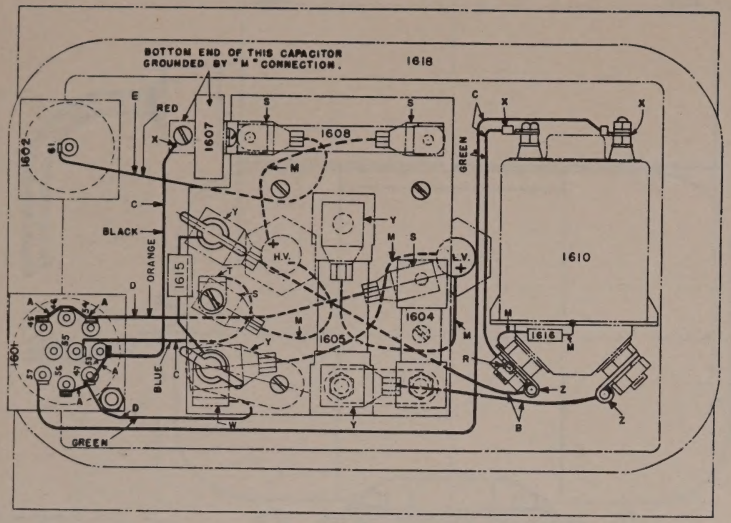
Fig. 12. Transmitter Tuning Unit TU-26-B, Connection Diagram





Weight of Case CS-48 ..... 4.375 lb

Fig. 13. Case CS-48, Dimensions and Weight



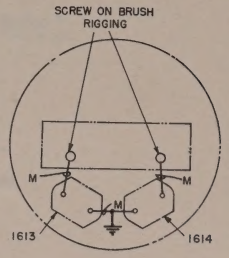
NOTE:- CUT ALL LEADS TO PROPER LENGTH SUCH THAT THEY TAKE THE POSITIONS SHOWN IN CONNECTION DIAGRAM WHEN TERMINAL BOARD IS SECURED IN PLACE.

TO PREVENT EXTERNAL BRAID OF "B" CONNECTIONS FROM FRAYING. ASSEMBLE CAP K-7876391 TO RELAY END OF EACH LEAD BEFORE SOLDERING TO TERMINAL.

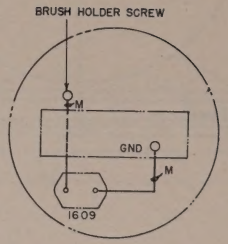
REMOVE METAL IDENTIFICATION TAGS FROM THE FOUR DYNAMOTOR LEADS AFTER CONNECTIONS ARE MADE.

CONNECTION	SIZE OF CONDUCTOR
A	.041" DIA. COPPER WIRE TINNED
B	# 8 AWG. S.T.-12249 (BLACK)
C	# 16 AWG. RUBBER INSULATION K-7872345
D	# 14 AWG. RUBBER INSULATION K-7872345
M	UNIT PIECE OF APPARATUS
E	# 16 AWG. RUBBER INSULATION (RED) K-7872345, PT-11.

CONNECTION	TERMINAL
X	K-7872831
Y	V-416575
Z	K-7870965 PT-2
W	V-1449899 "O"
S	V-417591
T	V-1450858
R	K-7875573

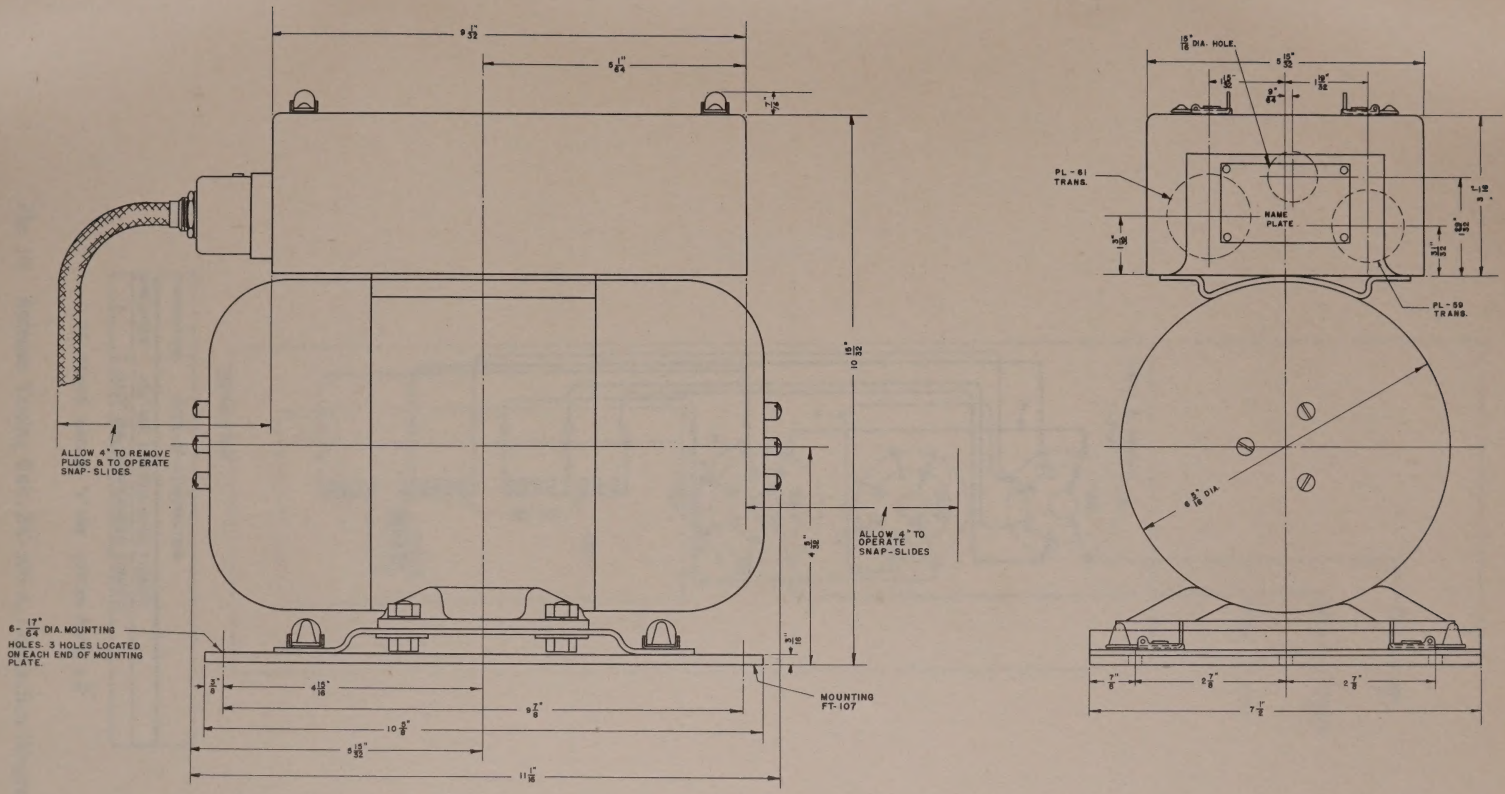


HIGH VOLTAGE END OF DYNAMOTOR



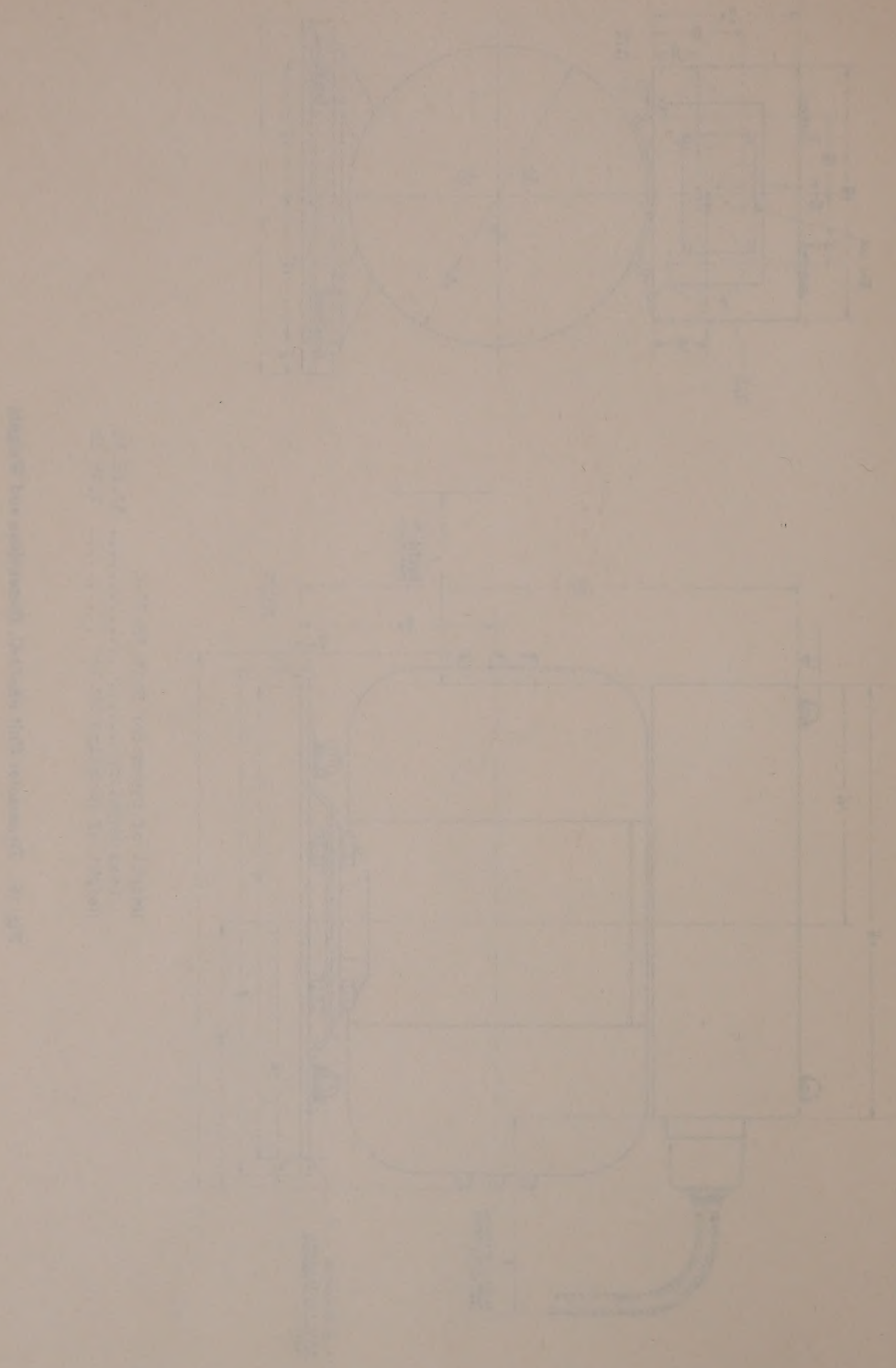
LOW VOLTAGE END OF DYNAMOTOR

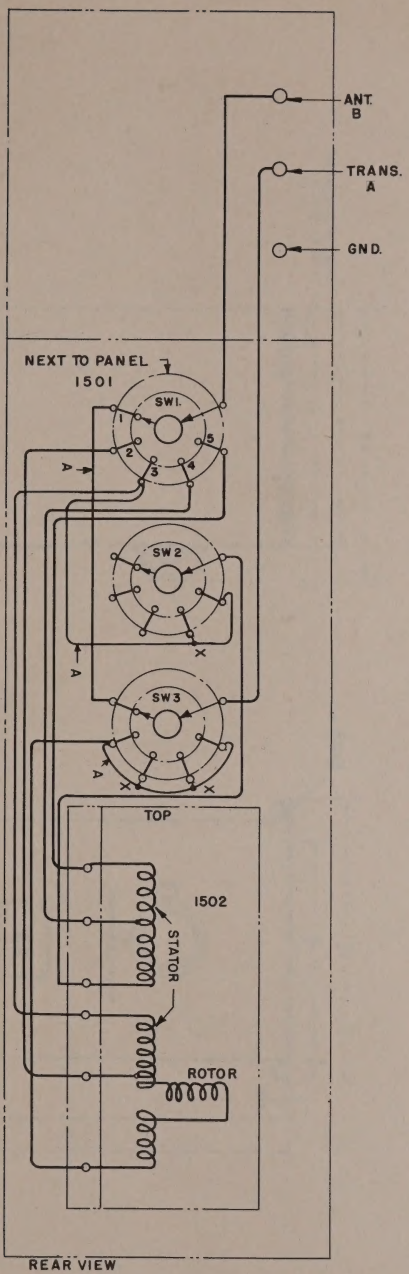
Fig. 14. Dynamotor Unit PE-73-C, Connection Diagram


ALLOW 4" TO REMOVE PLUGS & TO OPERATE SNAP-SLIDES.
6- 17/64" DIA. MOUNTING HOLES. 3 HOLES LOCATED ON EACH END OF MOUNTING PLATE.
ALLOW 4" TO OPERATE SNAP-SLIDES
MOUNTING FT-107
PL-61 TRANS.
NAME PLATE
PL-59 TRANS.
6 5/16" DIA.

Weight of Dynamotor Unit PE-73-C
Less Mounting ..... 37.25 lb
Weight of Mounting FT-107 ..... 1.45 lb

Fig. 15. Dynamotor Unit PE-73-C, Dimensions and Weights

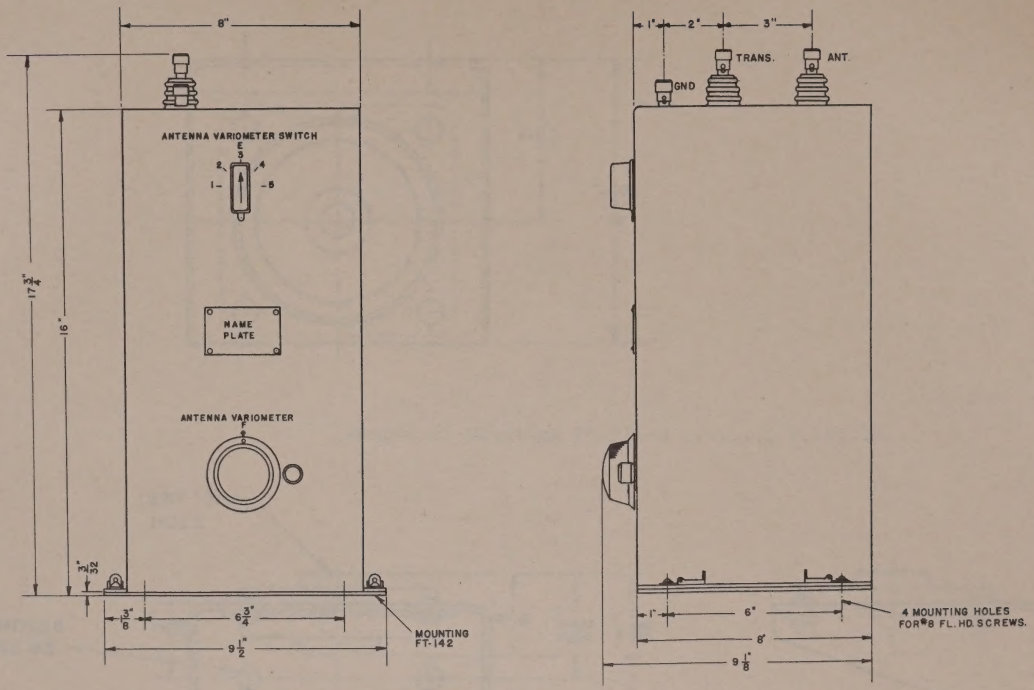




CONNECTION	SIZE OF CONDUCTOR
UNMARKED	.102" DIA. COPPER WIRE TINNED
A	.080" DIA. COPPERWIRE TINNED

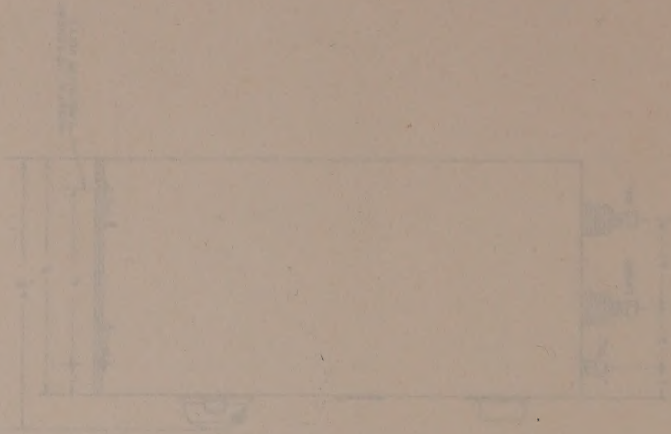
AT POINTS MARKED "X" USE COTTER PIN $\frac{1}{16}$" x $\frac{3}{8}$"

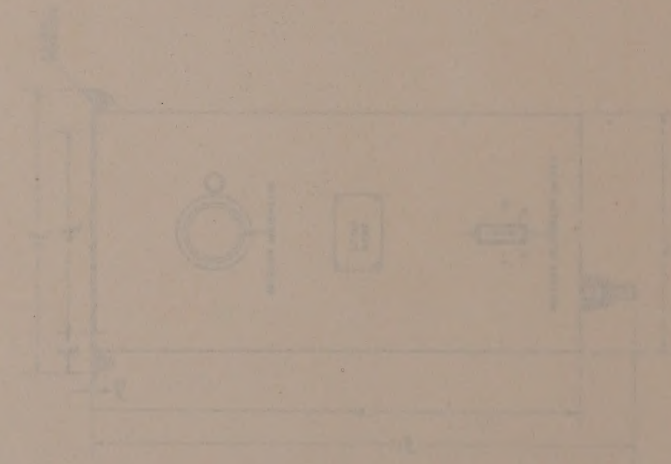
Fig. 16. Antenna Tuning Unit, BC-306-A, Connection Diagram

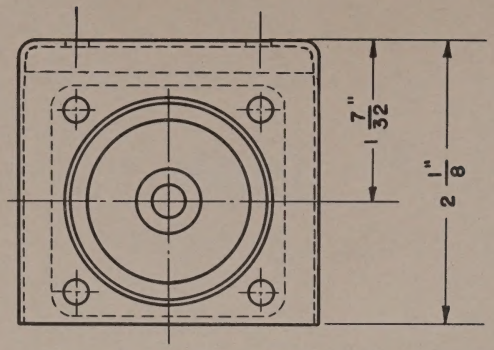


Weight of Antenna Tuning Unit
BC-306-A Less Mounting ..... 9.062 lb
Weight of Mounting FT-142 ..... 0.687 lb

Fig. 17. Antenna Tuning Unit BC-306-A, Dimensions and Weights







Weight of Mounting FT-115-B ..... 0.195 lb

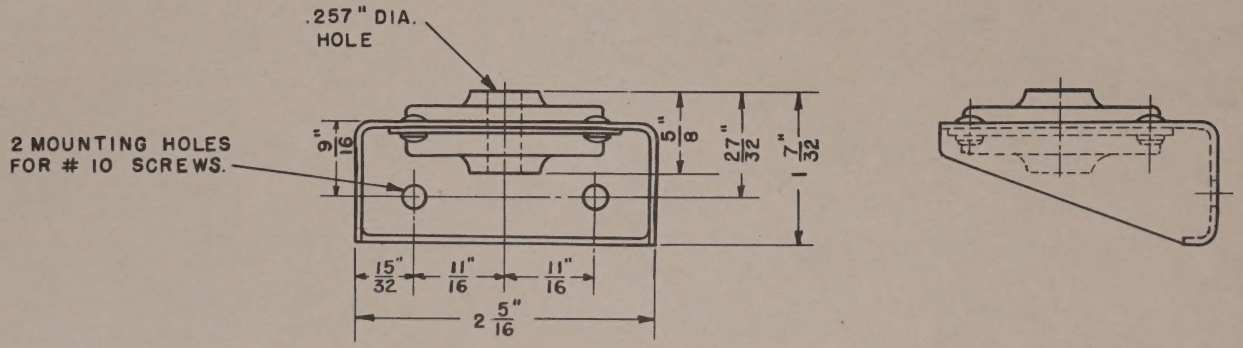


Fig. 18. Mounting FT-115-B, Dimensions and Weight